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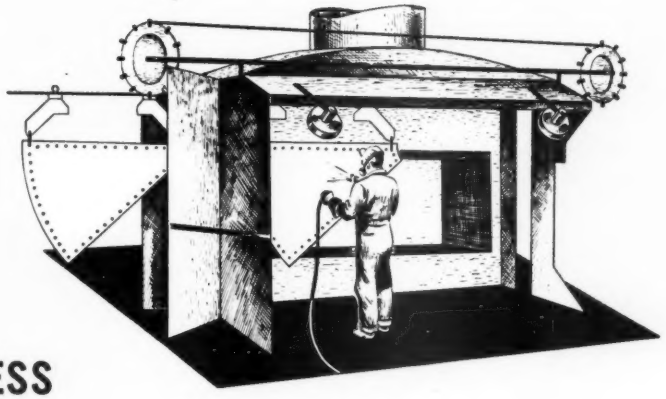

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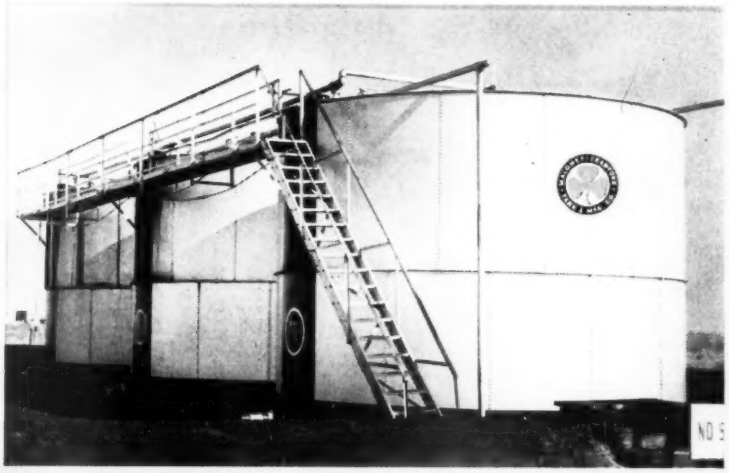

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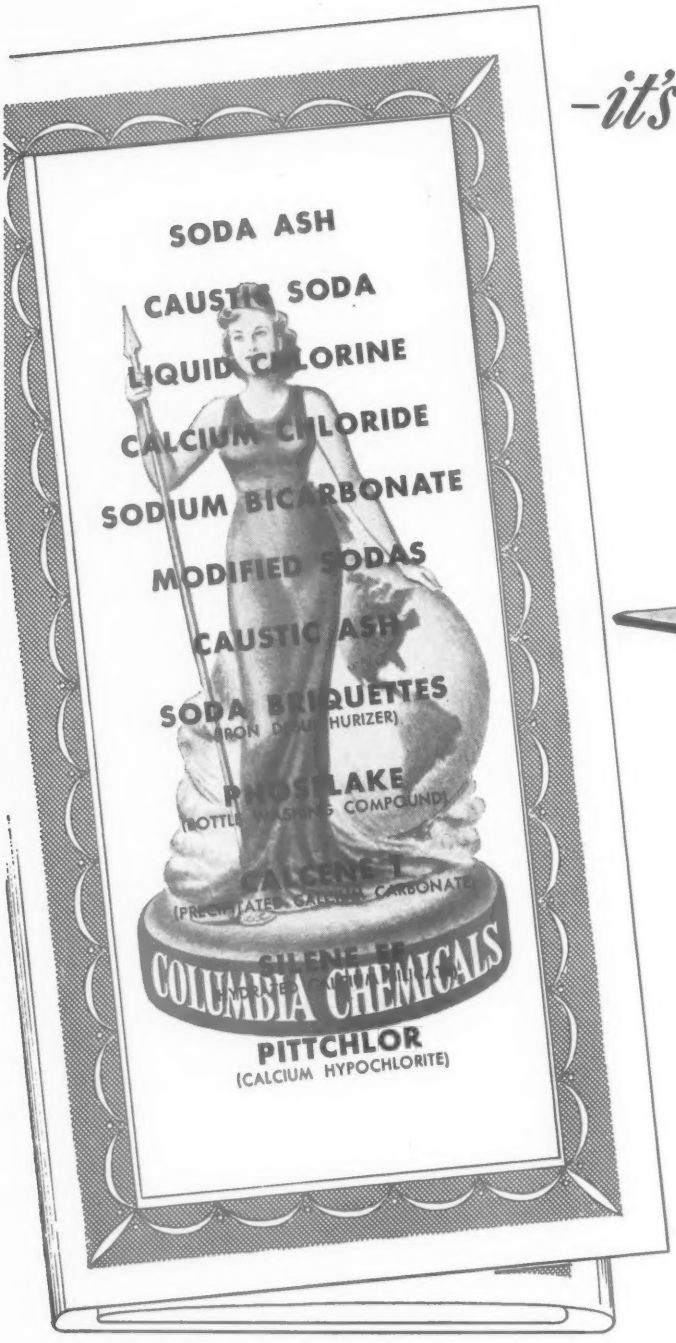

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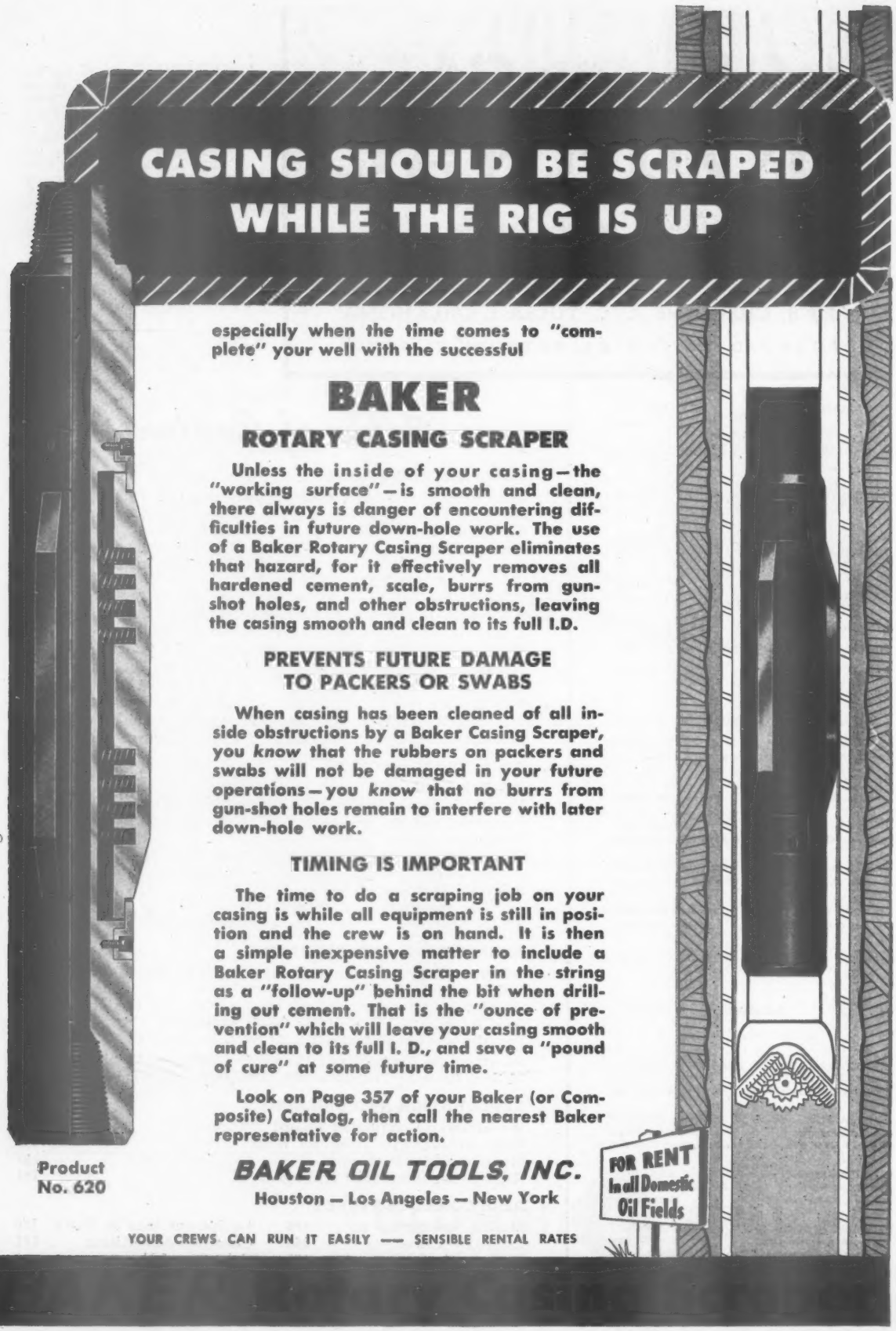

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Taking Stock

A YEAR AGO this page reflected the viewpoints of many students of the industry who were encouraged by the thoughtful consideration that independent refiners were giving to postwar operating programs. Last week a substantial number of these operators held their first meeting since the war as members of the Western Petroleum Refiners Association and took stock of their position after nearly 8 months of peace.

In the prepared papers and in the impromptu discussions there was no disposition to take a pollyanna attitude regarding the future. Developments over the past few months have been about as anticipated. It was conceded that an adjustment period whose length would be largely determined by the duration of government controls, was inevitable.

Fayette B. Dow, Washington counsel of W.P.R.A. and the National Petroleum Association and who has been intimately associated with the independent refining industry for many years, says that 257 operating plants in this country are owned by 234 independent companies. In a recent report to a Washington investigating committee he credits these independents with 16.49 per cent of the crude runs to stills while 144 integrated companies process 83.51 per cent of the total.

During the war the industrial importance of these small and medium-sized refining operations was readily apparent. Scattered throughout several states their products solved many problems of the emergency, including the all-important one of delivering products to consumers with a minimum of transportation.

The contention that these refiners grew fat during the war lacks accuracy. Operating margins and volume were generally satisfactory but taxes left no large surpluses. A lean period preceded 1941. Furthermore, of controlling importance is the fact that large expenditures are necessary to rehabilitate and modernize plant facilities in order that they may parallel in efficiency the large war-product refineries.

War controls in which all refinery operations were pooled as to crude oil have resulted in dislocations in peacetime supplies. Many small plants are confronted with the problem of where they will obtain their crude oil 1 to 10 years from now.

These are some of the changes that have taken place in 4 years having a bearing on the future of the independent refiner. There are additional phases of major significance to individual operators. In contrast to past conditions all operators are inclined to face conditions as they are. The future of independent refining—an essential part of the industrial whole for more than 85 years—is at stake. The Dow analyses and others furnish the facts for a constructive program. The next step is to do something about it.

Stop-Work Order Should Not Cripple Oil-Industry Program

by Henry D. Ralph

WASHINGTON.—The oil industry's construction program should not be seriously crippled, except in the service-station division, by the Government's new "stop work" order.

The purpose of the order is to channel building materials into veterans' housing projects and it is aimed at reducing the volume of industrial and commercial building using materials and labor that should go into home construction.

The Civilian Production Administration wrote its Veterans Housing Program Order No. 1 with the intention of exempting most industrial installations which are not primarily buildings, but the wording is far from clear and official interpretations are slow in being issued.

The order specifically excepts "pipe lines" and "wells" from the definition of "structure." It also exempts industrial machinery used in processing goods or materials and not building fixtures or utilities used in operating the building or for the comfort of those in it. There is a further exemption for any kind of equipment installed outside of and not attached to a building or other structure.

Any building project which was started by March 26 may be completed without reference to the order provided some materials had already been incorporated into the structure on the site. If the excavation was still in progress the construction must be halted, but if some foundation had been poured the work may proceed.

Small construction projects are also exempt if the total cost, including labor, contractor fees, materials and fixtures, is less than certain amounts. The limit is $15,000 in the case of "a factory, plant, or other industrial structure which is used for the manufacturing, processing, or assembling of any goods or materials," including a research laboratory or a pilot plant. This allowance applies to "structures used for oil, gas, or petroleum producing, refining or distributing (except service stations and garages)." The later structures have a $1,000 limit.

The tail wags the dog in the case of a $1,000,000 refinery needing one $16,000 building to house office and control instruments. The refinery equipment can be erected, but the building can't be started without a federal permit. If normal industry practice calls for several buildings in connection with a refinery, each costing less than $15,000 (not including the industrial process machinery housed therein) rather than a single big building, the small structures are permissible; but plans can't be changed to build a lot of small structures instead of one big one as a subterfuge to evade the order.

Authorizations to begin construction will not come from Washington ordinarily, but will be issued by 71 local CPA offices, at least one in each state. In each case the decision will not be that of the CPA man alone, but of a committee composed of outstanding and representative local citizens.

These committees are instructed to reject applications for construction projects which are not essential and which can be deferred, and the degree of essentiality is expected to vary with each locality in accordance with such factors as community needs, availability of the types of manpower involved, and shortages of the particular materials called for in the plans.

Example of Application

For example, it is expected that the local committee will approve construction of a service station close to a new housing development but reject one in a neighborhood already adequately served. Or it might approve plans for a bulk petroleum plant calling for materials which happen to be in ample local supply, while rejecting plans calling for materials badly needed for dwellings. The rule of reason is expected to apply.

In the case of a big refinery project where the amount of materials suitable for small homes is a very minor but essential part of the entire project, the local committees probably will issue authorizations because they will welcome such permanent additions to their local industries. However, if they think that either construction or operation of the refinery would drain off labor needed on a project considered more essential to the community they have the right to reject the application.

In such cases the prospective builder can appeal to CPA in Washington.

The main purpose of the order is to reduce construction of the type which uses materials and labor needed for small homes and apartments.

Natural Gas Looms as Huge Chemical Source

by Arch L. Foster

HOUSTON.—Natural gas is likely to become more important as a source of chemicals than for its present main use as a fuel gas, Dr. W. A. Cunningham, professor of chemical engineering at University of Texas, told the Southwest section of the American Institute of Chemical Engineers meeting.

"The fact that the big chemical companies are betting on the future of the Gulf Coast and are locating here is significant," Dr. James G. Vail, president of the institute, said.

Pilot plant tests for the removal of salt and other corrosive materials from crude petroleum have proved very successful, said C. G. Kirkbride, professor of chemical engineering, Texas A. & M. College, and T. A. Burtis, research fellow at A. & M. The process consists essentially of washing the oil with water at 250° F. Oil and water mixture is filtered through beds of fiberglas, fine glass fibers which coalesce the water particles which dissolve the salt, and then settle the water from the desalted oil. The fibers give best results with a layer of 5 in. depth of a density of 15 lb. per square foot.

Low octane naphthas can be converted to stable, high octane gasolines by dehydrogenation and cyclization as by the hydroforming process, it was stated by L. R. Hill, G. A. Vincent and E. F. Everett of The M. W. Kellogg Co. using a molybdena-on-alumina catalyst at 900°-1,000° F. and 150-300 psig. and with a high pressure of hydrogen in the reaction zone this process produces a highly aromatic motor fuel of about 80 per cent yield and 80 A.S.T.M. octane number, also a highly aromatic polymer boiling above 400° F.

Use of furfural as selective solvent in the extraction of butadiene from cracked and dehydrogenated hydrocarbons was discussed in detail by J. Happel of Neches Butane Products Co.'s technical committee.

A symposium on isomerization of butane and other hydrocarbons was presented Monday afternoon, H. A. Cheney and C. L. Raymond of Shell Development Co. discussing that company's process for isomerizing butane. The Universal Oil Products isomerization process was presented by J. A. Chenicek, J. O. Iverson, R. E. Sutherland and P. C. Weinert.

The isomate process for converting normal hydrocarbons to isoparaffins was discussed by J. E. Swearingen and R. D. Geckler, Standard Oil Co. (Indiana), while S. F. Perry, Standard Oil Development Co., talked on isomerizing light hydrocarbons.

Jacobsen Defends U. S. Policy In Summarizing Testimony

WASHINGTON.—The United States had a highly successful national oil policy for many years before the war, and its postwar model needs very few changes.

Such is the unanimous view of the oil industry, according to A. Jacobsen, president of Amerada Petroleum Corp., serving as industry spokesman to summarize the thousands of pages of testimony piled up during the past months by the Senate's special committee on petroleum resources.

Since the committee is soon to prepare a report on what course the Government should follow to prevent running out of oil, Jacobsen strongly commended the national oil policy recommendations adopted by the former Petroleum Industry War Council.

"These recommendations have been given the widest publicity throughout the oil industry and I am not aware of any opposition voiced against them in any quarter," he told the committee last week.

The salient points brought out by the many industry witnesses on each phase of the committee's hearings were summarized by Jacobsen, and he deftly showed that they all center on the same general conclusion—that the nation will be assured of ample supplies of oil if it maintains conditions under which private competitive industry can thrive as it has in the past.

We have never formalized our national petroleum policy, but we have had one, Jacobsen asserted, and it has made the American petroleum industry preeminent in the world. He listed its essential features as:

1. The industry has been based throughout on private, competitive enterprise.
2. The industry has operated on the principle of abundance—mass consumption and low price.
3. Tax laws (intangible drilling and depletion allowances) have recognized and made possible the risks inherent in exploration and production.
4. The industry has promoted technological advances for conservation, efficiency, and improved quality.
5. Conservation and efficient utilization has been fostered by state laws.
6. The American petroleum industry has become world wide in scope.

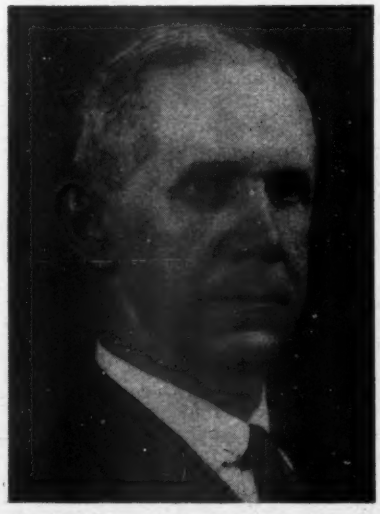
The postwar policy should be essentially the same, Jacobsen insisted. He listed the following points as summarizing the essential features of all industry recommendations on this subject:

1. The oil industry should remain a free, private, competitive enterprise, furnishing its own capital, and managed by private initiative.
2. Conservation to remain with the state governments.
3. Continuance of existing tax treatment.
4. Continuance of the Connally hot-oil law.
5. Continuance of the Interstate Oil Compact.
6. An import policy "which will permit the establishing of a price for crude oil high enough to encourage active exploration, full production, and technological development by the domestic producer, but not so high as to prevent foreign oil from supplementing our domestic requirements at reasonable prices, if at any time our full production at maximum efficient rates should not be sufficient to meet the demand."
7. Active diplomatic support of American nationals in their foreign oil operations.

Defends Bilateral Treaty

Jacobsen departed from his prepared statement to defend the Anglo-American oil treaty against what he described as untrue propaganda to the effect that it would invade states' rights in oil regulation, insisting that the treaty has the sole objective of the orderly development of the international petroleum trade. In answer to a question, he said that if there is any doubt about the treaty's language he would support a reservation declaring that it does not enlarge the powers of the federal Government over matters now within state jurisdiction.

The treaty cannot foster cartels, he said, because it provides for development and marketing of oil on a competitive and nondiscriminatory basis. As for the charge that the treaty would let in a flood of foreign oil, Jacobsen pointed out that without a treaty there is no limit to the amount of petroleum that can be imported with the present tariff, and that the best way to deal with such a problem is a consultative body as provided in the treaty.



A. JACOBSEN

Senate Committee Hears Independent Marketers

WASHINGTON. — The position of the independent petroleum marketer in competition with the integrated major companies struggling for volume outlets got a brief hearing before the Senate petroleum resources committee last week.

Chief complaining witness was Eugene M. Callis, president of Petrol Corp. of Philadelphia, who said there ought to be a law to segregate marketing operations in integrated companies so losses in this branch cannot be subsidized by profits from other activities. He also asked government action to assure independent marketers access to common-carrier pipe lines on reasonable terms.

While Callis listed marketing practices of majors which he said made it almost impossible for independent dealers to stay in business, one of his chief criticisms was against the wartime marketing and distribution orders of Petroleum Administration for War. He charged that PAW had been dominated by the majors and asked that any future industry advisory committees of government agencies give equal representation to truly independent operators and also contain a representative of the Department of Justice to protect the public and preserve competition.

Callis was promptly answered by Carl Kieser, senior attorney for Socony-Vacuum Oil Co., Inc., who categorically denied that his company engaged in any of the practices listed by Callis. The fact that Petrol has had a short but highly successful and expanding life is ample proof that there is opportunity for an independent to enter the oil-marketing business and prosper, and a refutation of the charge that monopolistic practices of the majors have created a bad economic climate, he told the committee. Kieser said the financial losses cited by Callis were due entirely to the operation of PAW orders, which

he declined to discuss, rather than to the activities of competing companies.

Historical and current statistics bearing on the subject of concentration of economic power in the petroleum industry, particularly its marketing branch, were presented to the committee by William H. England, chief economist, and James A. Horton, chief examiner, of Federal Trade Commission. Based on published reports of the commission, plus supplemental current data, these presentations showed that big companies in the oil industry have grown progressively larger during the past 40 years and that, generally speaking, the bigger companies made higher profits while the smallest companies, as a group, lost money in 1940.

The big oil companies have three big advantages, England said, namely, control of cheap methods of transportation, control over marketing outlets, and great wealth which permits them to absorb local or periodic losses. This puts independents in a precarious condition, he concluded, because, due to the size of this country, independents have to market locally and are subject to the vagaries of local conditions.

Cooperatives No Threat to Oil Industry, Spokesmen Declare

WASHINGTON.—The idea that the cooperative movement carries any threat to the oil industry was ridiculed by two witnesses appearing before the Senate petroleum resources committee last week.

There are eight integrated farm cooperatives in the U. S. which have petroleum operations and they own less than 800 producing wells and 11 refineries, said F. R. Olmsted, general counsel of the Consumers Cooperative Association of Kansas City. In 1945 they produced 1,645,314 bbl. of crude, less than 0.1 per cent of the United States total. At the same time they purchased 10,939,415 bbl. of crude from independent producers and 8,901,835 bbl. from majors, proving, said Olmsted, that coops depend heavily on the oil industry for their crude.

A few petroleum marketers are injured when farmers decide to supply themselves with oil, Olmsted admitted, but insisted that in the over-all national interest this is more than compensated by the increased purchasing power of the farmers in the neighborhood. Aside from this the oil industry is not confronted with any problem from coops, and independents, majors and coops can live side by side in peace without any trouble, the way he told it.

His story was most disarming. Farmers have acquired oil facilities solely to supply their own needs, and farm coops have no intention of entering the oil business as such. Coops are simply one form of business mechanism, liked by farmers because they permit products to be obtained at cost, assure continued sources of supply, and provide control over quality. Coops exist only to supply their members; sales to nonmembers are purely incidental, just a public service to people who run out of gas nearby. Coop refineries sell only to local distributing coops, except that they exchange crude and products with other refineries and, purely incidentally, sell certain surplus byproducts to both majors and independents. But coops never cut prices nor engage in marketing wars.

As for the tax advantage, Olmsted concluded that spokesmen for the oil industry have been misled by the vicious and unscrupulous half-truths propagandized by an organization calling itself the National Tax Equality League. Coops do pay taxes, lots of them, and some kinds even pay federal income taxes on profits from their incidental sales to nonmembers, Olmsted assured the committee. The only possible ground for the charge of a tax advantage is that coops are free from double taxation; the profits of ordinary corporations are taxed once at the source and again when the dividends are received by the stockholders, while coop profits are taxed only when distributed to the stockholders. If the members happen not to want their earnings paid in cash, the coop uses the funds for some new project which will bring additional savings to the farmers.

Admits to Pyramiding Capital

Under questioning, Olmstead agreed that this results in pyramiding the capital structure, but insisted that this is due not to a tax advantage but to the stockholders' willingness to forego dividends.

Are coops interested in foreign oil? Chairman O'Mahoney asked. In theory, yes, but not actually, Olmsted replied. Nothing definite has been done. But if the major oil companies of this country fear that we are running out of oil and they must protect themselves by obtaining foreign supplies, then the farmers, too, should investigate the prospects for obtaining future supplies from abroad.

Coops are only peanuts in the oil industry, according to Olmsted, and it is odd that they are attracting so much attention.

This view was echoed by Alfred L. Kiltz, counsel of the petroleum division of the Indiana Farm Bureau Cooperative Association, Inc. From its own wells in Indiana, Illinois, and Kentucky, his coop produces only 2,000 bbl. per day, and the remainder of the crude needed by its 3,500-bbl. refinery at Mt. Vernon, Ind., is purchased from independents and majors. Moreover, as soon as his coop got into the oil business it paid the full posted price for crude, which was more than the majors had been doing in that area, so independent producers have benefited. Also, during the past 3 years this coop has contributed $312,000 to independents on bottomhole letters, has loaned them $349,497 with never a foreclosure, and has loaned casing, rods, tubing, and other equipment. The refinery can supply only half the members' requirements, so the balance is purchased from the industry. Kiltz assured the committee that his coop has nothing but the most friendly relations with both majors and independents in its area.

Oil Compact Expands Economic Activities

OKLAHOMA CITY. — The Interstate Oil Compact Commission has enlisted the aid of some of the nation's top-ranking economists to keep it advised of economic trends in the oil and gas industries, it has been announced by Earl Foster, commission secretary.

"The compact's economics advisory committee, originally composed of three members, has been revised and enlarged to better keep the commission constantly informed on all economic factors relating to oil and gas," Foster said. The committee members are R. J. Gonzales, chairman, Humble Oil & Refining Co., Houston; J. H. Salmon, Shell Oil, Inc., New York; John Boatwright, Standard Oil Co. of Indiana, Chicago; James V. Brown, Independent Petroleum Association of America, Washington; A. J. McIntosh, Socony-Vacuum Oil Co., Inc., New York; H. J. Struth, Texas Mid-Continent Oil & Gas Association, Dallas; Sidney A. Swensrud, Standard Oil Co. of Ohio, Cleveland; Fred Van Govern, American Petroleum Institute, New York; and Clarel B. Mapes, Mid-Continent Oil & Gas Association, Tulsa.

The group of councillors to the committee is composed of Alexander Sachs, New York; Joseph E. Pogue, The Chase National Bank, New York; E. DeGolyer, DeGolyer & McNaughton, Dallas; and Stewart P. Coleman, Standard Oil Co. (New Jersey), New York. Pogue, Sachs and DeGolyer were the three members of the original economics committee and have served the compact since 1938.

THIS WEEK

PRICES—OPA ended several days of confusion on the 10-cent crude advance by finally issuing formal order April 1. . . . Agency continues study of petroleum-price ceilings. . . . Inference left that product ceilings may be tilted to avoid hardship on refiners. . . . ¶Tank-car gasoline prices may return to ceiling levels as first reaction to higher crude costs. . . . ¶Residual sales to interior railroads moving at higher prices. . . . ¶Year extension of OPA considered likely. . . . ¶Oil buyers prompt in posting 10-cent increase, effective 7 a.m., April 1. . . .

NATURAL GAS— Final hearings in FPC natural-gas investigation scheduled in Washington, starting June 17. . . . Real battle in prospect between gas industry and rail-labor interests. . . . Regional hearings have been tame in comparison. . . . ¶Another offer made for Big-Inch line. . . . Bid contemplates movement of Carthage gas to New York City. . . . Little Big-Inch line would continue delivery of petroleum products to East Coast. . . . ¶Oil industry criticizes SPA recommendations for disposal of WEP pipe lines. . . . ¶FPC Chairman Olds renews denial of any plan for extending control to oil production.

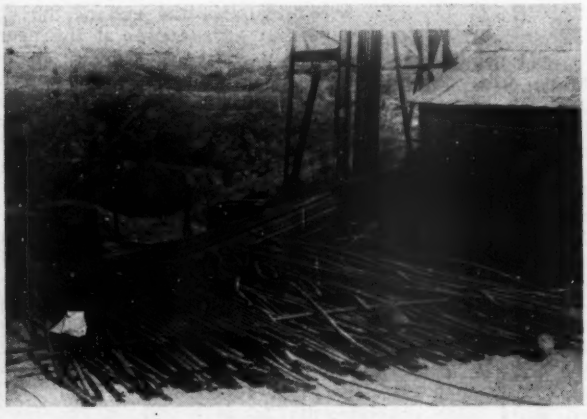
CONGRESS—Resumption of prewar national-oil policy advocated before O'Mahoney committee. . . . A. Jacobsen summarizes thousands of pages of industry testimony. . . . Anglo-American oil agreement defended, cannot foster cartels, Jacobsen asserts. . . . ¶Independent marketer suggests segregation of sales departments of integrated companies. . . .

REGULATION—Veterans housing order should not seriously cripple oil-industry rehabilitation program. . . . Service-station building and remodeling absorbs brunt of restriction. . . . Processing equipmet, pipe lines and wells specifically exempted from order. . . . Local committees will decide most construction applications on basis of individual merit. . . . Labor supply and availability of materials will be determining factors. . . .

INTERNATIONAL—Mexico outlines $5,000,000 drilling program. . . . ¶British and United States agree on settlement of oil lend-lease transactions. . . . ¶Number of active drilling rigs in Venezuela will total 135 by end of year. . . . Most of 35 additional rigs will be used in expanding exploratory drilling. . . . Actual number of new rigs will be around 60 to 75. . . . Older equipment will be retired at accelerated rate. . . . ¶Prospects dull for return of American companies to much of Europe. . . . ¶American delegation of technicians completes analysis of China's producing and refining potentialities. . . . ¶Shell companies plan investments of $45,000,000 this year in Venezuelan operations. . . .

SUPPLIES—Navy's need for special fuel oil becoming more critical. . . . Commitments by industry insure daily supply of 144,064 bbl., demand fixed at 270,000 bbl. . . . Pressure intensified for higher production in Texas. . . . Railroad Commission divided on issue of granting Navy request. . . . ¶War Shipping Administration also short of fuel oil. . . . Delays experienced in sailing of relief vessels. . . . ¶Navy considering use of tank cars to circumvent price restrictions. . . . ¶Next Texas allowable hearing scheduled April 19. . . . ¶January imports averaged 413,000 bbl. daily, nearly double receipts a year ago. . . .

LABOR—Disputes continue to plague equipment end of industry. . . . ¶Department of Labor shows 65 per cent of oil workers organized in 1945. . . . ¶Only two oil industry installations remain under Navy control, pending labor settlements. . . . Gulf Oil Corp. plant at Port Arthur returned to company management. . . .



Left: This view shows how the Japs camouflaged storage tanks in the Yenangyaung oil fields, Burma, during their occupation. Four-inch pipe was used as uprights, around which was woven bamboo. Right: Here's where the Japs straightened oil-field pipe in the Yenangyaung field. The picture shows the pipe before and after straightening

Navy's Fuel Supply Critically Short; No Relief in Prospect

by Dahl M. Duff

THE Navy gained an important supporter but no additional crude last week in its efforts to increase Texas production to meet a fuel-oil shortage.

Converted to the Navy's case after a conference in Washington was Commissioner E. O. Thompson. Although he previously had maintained above-ground stocks of crude are more than sufficient, Thompson said he was convinced there is "nothing phoney" about the Navy's request.

However, the other two commissioners, Olin Culberson and Beauford Jester, were not as easily persuaded. That the commission would make a change in the allowable before its regular April 19 hearing was considered unlikely.

After Thompson conferred with Navy officials in Washington, six representatives of the Navy, Army, War Shipping Administration, and the Office of War Mobilization and Reconversion appeared before Thompson and Jester at a commission meeting in Midland, Tex., which was originally called to study natural-gas conservation.

Missing the Midland session, Culberson followed Thompson to Washington where he was to testify before the Federal Power Commission in connection with export of gas to Mexico. Making plain his opposition to any increase in crude allowable, Culberson said he did not consider it proper for the other commissioners to consider the crude problem at a conference called to discuss gas waste.

Invited to Hearing

After hearing the federal group at Midland explain the fuel shortage, Jester reiterated his contention that the shortage is due to the preference of refiners to process the more profitable gasoline rather than fuel oil. He invited the federal representatives to the statewide hearing April 19 and told them they should in the meantime get a 58-cent a barrel price increase for Texas crude.

Capt. B. B. Biggs, Navy officer and deputy executive officer of the Army-Navy Petroleum Board, said the Navy is in a "tight spot," needing 270,000 bbl. of special type fuel oil daily with commitments as of March 27 of only 144,064 bbl. The Navy, he added, has twice run out of oil in New York harbor within the previous 2 weeks.

Biggs said a conference with oil industry representatives early in March had developed that crude availability and price were responsible for the shortage. He said to obtain the needed crude, it might be necessary to move some in tank cars, for which the Navy could pay higher prices after approval of the Office of Price Administration.

Comdr. Ralph S. Fowler, chief of the fuel division of the Navy's bureau of supplies and accounts, testified the Navy's needs are based on the minimum for national security. The Navy, he said, is not interested in price but is desperately in need of fuel.

WSA Plight Explained

Michael J. Deutch, special assistant in the office of War Mobilization and Reconversion, told the group at Midland that the plight of the War Shipping Administration is as bad as that of the Navy. Maury Wells, WSA representative, said the agency's requirements were 344,000 bbl. daily and that it is supplying 80 per cent of the shipping tonnage to take relief goods abroad. He said some fuel recently had been borrowed from the Navy. WSA requirements, he said, will drop 10 per cent by September and 20 per cent before the end of the year.

Deutch said he knew of no plan to realert Petroleum Administration for War but added that its records and staff would be kept intact until the end of the emergency. Another officer at the hearing, Comdr. D. V. Wengrovius, member of the joint Army-Navy purchasing board, said no supplies are being obtained from the British and that if the oil is not forthcoming, the Navy will be forced to do whatever is necessary to obtain it.

Culberson was invited to confer with Admiral Horne of the Army-Navy Petroleum Board while he is in Washington. Before leaving Austin, he issued a statement that "the present situation is not the result of the refusal of the commission to grant permission to produce enough crude.

"It is, in my opinion, directly chargeable to economic forces and possibly to a failure of some Washington authority to function efficiently. . . . I am strongly persuaded that a return to the purchase of fuel oils on a gravity basis by the Navy would see an immediate change in the present picture."

He said the producers of Texas "have drawn on their reserves at an excessive rate" during the war and asserted that "surely, the producer is not again going to be expected to sacrifice further when fair prices or the removal of price controls on petroleum and its products could and would bring about full relief for the present claimed shortage."

Texas oil production for the week ending March 30 was 1,817,450 bbl. daily, unchanged from the previous week. Its production February 23 was 2,109,800 bbl. daily. The commission cut the allowable 350,000 bbl. daily for March, and, refusing the telegraphed request of a group of federal officials, granted an increase of only about 45,000 bbl. daily for April.

After the Midland hearing, Thompson said relief for the Navy can come only through lifting of OPA ceilings or an emergency increase in crude production. He urged his colleagues to issue an emergency order for a 200,000 bbl. daily increase.

On the other hand, Jester said he could not understand how the emergency could "slip up" on the Navy. He charged major companies are interested in increasing production so that heavy stocks will block a price rise when OPA controls are lifted.

War Powers in Effect

Thompson pointed out that war controls and war powers are still in effect. "The federal Government can direct more oil be made available," he said. "They prefer cooperation. The Navy could refine this oil in the war plant refineries but the administration prefers that the Government not go into the oil business. The administration could quickly . . . resume the allocation and directives on oil."

Three other major oil producing states last week set allowables for April that were little changed from the March figures. The Oklahoma Corporation Commission accepted the 367,000 bbl. daily total recommended both by the United States Bureau of Mines and Walker T. Pound, chief conservation officer for the commission. The March allowable was 359,525 bbl. daily. Production March 23 was reported at 365,200 bbl. daily.

In Louisiana, the Department of Conservation set April crude production at 398,022 bbl. daily, a reduction of 8,432 bbl. from March. The Kansas Corporation Commission approved 250,000 bbl. daily production for the state—the same as March—on recommendation of T. A. Morgan, the state conservation officer.

Gasoline Market Expected to Rise Responding to Higher Crude Price

THE exact effect of the 10-cent crude ceiling increase on gasoline markets was obscure early this week, although the upward break in quotations was expected.

Several other buoying influences also were being felt. The cut in the allocation of lead by the Civilian Production Administration was reported to be tightening the market for premium motor fuels.

Marketers were forecasting a rise in gasoline quotations of ¼ cent per gallon and possibly more as a result of the crude rise. The situation was expected to crystallize later in the week. Gasoline in the Oklahoma Group 3 market, as well as in many other sections, has been below ceiling for several months.

Widespread indications of more favorable price-relief action by the Office of Price Administration and of the possibility of complete removal of oil controls last week was a factor in lifting prices of leading oil stocks to their highest levels since 1937. More pressure for the lifting of oil controls came last week when Chairman Patman of the House small business committee told Paul Porter, price administrator, that continuance of controls "only serves to encourage the trend toward monopoly."

Sharing in the general optimism over the likelihood of price decontrol was the equipment segment of the industry. A report from Washington last week said price ceilings on well drilling machinery and other large equipment used in the oil industry probably will be removed within a month.

New York Reports Firming

From New York came a report that gasoline was showing signs of firming and that premium motor fuel is becoming tighter. Residual was said to be as tight as ever, and it was believed the recent 21-cent a barrel hike had not yet shown its effect in easing supply. No. 2 fuel oil was easing due to warmer weather, but buyers for export were reported having difficulty assembling full cargos.

Prices remained stable at the end of last week in the West Coast area. Demand for quality products continued high, and a record gasoline consumption was indicated as resorts prepared for heavy vacation travel. The demand for premium motor fuel was reported working adversely on some independent refiners unable to supply the product. Fuel and heating oils were in heavy demand, and diesel production was below requirements.

Some market observers were predicting a long-time tight market in residuals. In the immediate future was the coal strike which was expected to increase demand for industrial oils. The contract price for residuals sold by refiners to railroads was said to be stabilizing at about $1.05 a barrel, although some refiners were reported seeking $1.11. Published quotations for residuals rose to $1.11 to $1.18.

Offer of $80,000,000 Made For War Emergency Lines

NEW YORK. — Announcement of an $80,000,000 bid to the War Assets Administration for acquisition of the big and little-inch pipe lines was made here last week by Charles H. Smith, consulting public utility engineer, and spokesman for a group which will finance the deal.

If the bid is accepted, Smith says the big-inch will be converted—at an estimated cost of $40,000,000 — for transportation of natural gas from Texas, and run by "Big Inch Gas, Inc." The little big-inch and the Southwestern Emergency lines would be used as oil products carriers and operated by "Big Inch Oil, Inc." The $40,000,000 estimated conversion cost includes the construction of a line from Linden, N. J., to New York.

About $90,000,000 would be obtained from sale of securities by investment banking firms, it was explained, and $30,000,000 from Government lending agencies.

The Transcontinental Natural Gas Co., backed by Texas interests, recently bid $40,000,000 for the lines.

New Engineering Addition To Be Built at University

NORMAN, Okla.—Preparations are moving forward here for the erection of a new $350,000 petroleum and chemical engineering addition to the main building of the college of engineering of the University of Oklahoma.

Funds have been earmarked for the project which has long been sought by university officials and alumni. A rapidly rising enrollment, made up largely by returning veterans, many of whom are studying oil engineering, has given emphasis to the expansion program.

January Imports Show Huge Increase

WASHINGTON.—United States' imports of petroleum and its products in January showed an increase of 85 per cent over the corresponding month of 1945 and an increase of 29 per cent over December 1945.

This was shown in data from the Independent Petroleum Association of America and originally assembled by the Bureau of Census, Department of Commerce. I.P.A.A., to which oil importation is becoming a major source of concern, said the import rate is approximately equal to the reduction in domestic crude output brought about by the ending of the war. The imports all came from the Caribbean region, mostly Venezuela. About 65 per cent was crude, the balance made up of fuel oil and asphalt. The table lists detailed import figures:

PETROLEUM IMPORTS
(All figures in thousands of barrels)

	January 1946		December 1945	January 1945
	Total	Daily av.	total	total
Total imports	12,806	413.0	9,919	6,923
Imports by products:				
Crude petroleum	8,302	267.8	6,789	3,958
Motor fuel	....	....	....	141
Distillate fuel oil	581	18.7	551	6
Residual fuel oil	3,878	125.1	2,579	2,773
Asphalt	45	1.4	....	45
Total refined	4,504	145.2	3,130	2,965
Imports from:				
Venezuela	8,318	268.2	6,221	3,093
Netherland West Indies	3,122	100.7	2,840	2,946
Mexico	375	12.1	325	68
Colombia	982	31.7	524	787
Trinidad and Tobago	9	0.3	....	12
Other	....	....	9	7
Imports by tax classification:				
Taxable for domestic consumption	9,962	321.3	7,894	3,960
Free for vessels	2,499	80.6	1,540	6
Free for government use	345	11.1	485	2,957

WASHINGTON WATCHING

BY HENRY D. RALPH

Year's Extension of OPA Seen as Likely

WASHINGTON.—The bill to give Office of Price Administration another lease on life is being written this week by the House banking and currency committee behind closed doors. This predominantly pro-administration and unoriginal group is generally expected to recommend a year's extension of the law with little or no change. Observers who sat through the weeks of hearings and listened to questions from the dais concluded that the only amendment with much chance of adoption by the committee would be one to require OPA to decontrol any commodity being produced in sufficient quantities to fill current demands.

OPA officials have had a bit of difficulty making a case against such a reasonable-appearing amendment, their chief argument being that while supply and demand might look in balance at a given moment, the "inflationary forces" at work are so strong that the price might skyrocket unless OPA has power to clamp the price lid down at any time. They point out that OPA already has suspended price ceilings on a numerically large number of articles which don't enter into the ordinary man's cost of living, claiming that this proves that OPA is right on the job with its decontrol program.

Porter told the House committee: "The act does not need amendment in order to have a decontrol policy with the proper objective of removing price ceilings as quickly as is consistent with maintenance of general economic stability. I pledge that OPA will do just that."

Psychological, Not Statistical

Real reason why OPA won't decontrol oil is psychological, not statistical. By all the tests of law and cost accountancy the crude-oil price ceiling should have been raised long ago and be eliminated now. OPA has virtually admitted this in its promise to work out a plan for suspension of petroleum price controls within a few months.

But it fears that the political and psychological reactions to an increase in oil prices would be terrific. It reasons that the public, which assumes that everyone in the oil business is per se fabulously wealthy, will conclude that OPA has yielded to pressure from the "powerful oil lobby" and has sanctioned an "oil-price grab"; that producers of everything else will demand treatment equal to that given the "rich" oil industry; and that even a tiny increase in gasoline and fuel-oil prices will feed the flames of the "inflationary psychological forces" which are said to be rampant in the land.

In other words, it's not the dollars and cents involved in a possible increase in oil prices which worries the administration, but the precedent that might be set for other commodities.

Many items of oil-industry equipment are due for a price increase, suspension of price ceilings, or complete decontrol in the near future. A number of minor price increases are being allowed to compensate for the increased cost of steel or on specific showing of higher production costs.

OPA is adopting a policy of generally suspending controls over many types of producers' capital equipment and machinery, including oil-industry equipment. In each case it must make a study to be sure that decontrol presents no substantial threat of diversion of materials, manpower, or facilities from production that is more essential in the general reconversion program, does not impair effective price control of other commodities, and is not significant in cost of living or the operating costs of other industries.

England and U. S. Settle on Oil Lend-Lease Terms

THE complicated lend-lease petroleum business between the governments of the United States and England have all been settled, or settlement formulas approved, in a series of agreements just signed in Washington. These agreements wind up the whole lend-lease matter, and fill in the details in accordance with master agreements made earlier. They cover a great many subjects, but the one on petroleum is as voluminous as all the others combined because the two governments conducted joint military oil activities in all parts of the globe.

England agrees to pay for all petroleum products accepted since September 2, 1945, the date President Truman announced lend-lease had ceased, except for such supplies as the U. S. armed forces want to take over in England. The U. S. agrees to pay for petroleum products drawn by the Army and Navy since September 2 from British suppliers in Trinidad, Curacao, and Abadan under the procedure we called reverse lend-lease and the British called reciprocal aid. In other parts of the world stocks and installations are divided up in a variety of pragmatic ways.

Among the claims and counterclaims negotiated, Britain agreed to pay us $12,000 for transportation of petroleum products in the Sudan; $2,800,000 for gasoline diverted from military stocks to increase the English civilian ration after June 1, 1945; $5,100,000 for commercial exports of lend-lease oil products from England to Eire, France, West Africa, and Sweden; and $1,000,000 for diversion of lend-lease materials to British oil companies in the Middle East.

On the other hand, the U. S. agreed to allow British claims totaling $6,700,000 for sales by our forces to civilians in Dakar, Brazil, and North Africa of reciprocal-aid petroleum products originally supplied to us by the British.

The agreement lists in detail the share of each government in joint stocks of petroleum products at military installations throughout the world, and also the petroleum installations in various places.

Distribution of Interests

The lend-lease interest in petroleum installations in the United Kingdom is transferred to the British. Installations in British Colonial dependencies are retained by the U. S. Government. Those in third countries and which have been or may be diverted to civilian use are to be settled under the general agreement for miscellaneous lend-lease claims.

Petroleum installations in the United Kingdom are not listed, and those in British dependencies are chiefly bulk plants and airport installations in Africa. The joint installations in third countries, and for which claims are to be settled under the master formula, include a bulk plant in Iceland, the Abadan-Ahwaz-Khor-

ramshar pipe line in Iran, the Beirut 10-in. black-oil pipe line in Lebanon, six drum and can plants in Egypt, and these Egyptian pipe lines: Agrud-Cairo 6-in. (white oils), Suez-Port Said 8-in. (black oils), Timsah-Nefisha 10-in. (black oils), Gaboari (Alexandria) 6-in. (black oils), Amriya (Alexandria) military pipe lines (white oils), and the airfields pipe lines at Fayid, Kabrit, Kosiarit, and Shandur.

Certain oil transactions, agreed to when lend-lease was active, are to be carried to completion, including: Deliveries of U. S. crude oil to Canada as part of the aviation training program; exchange of aviation gasoline at Bahrein; supplying petroleum products to Iceland; and U. S. payment to suppliers for aviation petroleum products used by the Royal Air Force in Newfoundland and Bermuda.

Under a special provision for continuing the operation of the Cairo-Suez pipe line, England will pay the U. S. its share of profits in currency received in course of operations.

The U. S. reaffirmed the agreement made in 1944 under which the two governments planned to expand the output of petroleum products in Curacao, Trinidad, and Bahrein, and will complete the payments due to the United Kingdom.

Two paragraphs of general interest to the entire American oil industry appear in the final lend-lease settlement agreement. Under one of them the British Government apparently agrees to facilitate the importation of American oil equipment into British areas. The other looks like a mutual pledge to speed ratification of the Anglo-American oil treaty and in the meantime to act as though it were in effect. They read:

"In the course of negotiation of this agreement several questions which have arisen in connection with restrictions imposed on American oil companies, limiting the importation from the United States of plant and materials necessary to rehabilitate American oil properties in certain British areas, were discussed and cleared up individually on a satisfactory basis. The Government of the United Kingdom agrees that it will not impose or encourage the imposition of restrictions on the importation of petroleum materials from the United States likely to prejudice American companies in relation to their competitors.

"The principles of general commercial policy recently discussed between the two governments relate to petroleum as to any other commodity. The two governments recognize the importance of early agreement on petroleum questions of mutual interest and, pending the establishment of formal intergovernmental machinery to deal specifically with petroleum questions, will consult together as necessary.

Equipment Industry Still Plagued By Strikes; Refinery Released

THE equipment section of the oil industry was troubled with another strike this week after 75 members of the International Association of Machinists walked out at the Houston plant of the Well Equipment Manufacturing Co.

C. K. Stillwagon, company president, said the strike was illegal since no union has been certified as the collective bargaining agent. He said the firm could not recognize any group until a National Labor Relations Board election had been held.

A union official said the walkout was precipitated by the discharge of three men for union activities. Stillwagon said the plant would remain open, and "employes desiring to return to work are free to do so."

Further progress was reported in negotiations to settle the dispute between Hughes Tool Co. in Houston and the C.I.O. steelworkers union. The controversy went into its eleventh week Monday.

Hopes for settlement of the Hughes dispute rose after Noah Dietrich, executive vice president of the firm, met in Washington with Phillip Murray, C.I.O. head and steelworkers' president. Late last week, company representatives had a new union proposal under study.

The Navy still held two plants of the 53 oil installations seized last October under presidential order during a strike. They were Gulf Oil Corp. at Toledo, Ohio, and American Liberty Oil Co. in Texas City, Tex. The Navy released the Port Arthur, Tex., refinery of Gulf after a settlement was reached between the company and union officials. About 4,000 workers were involved.

National Labor Relations Board rulings affecting the oil industry during the week:

Dismissal of a petition filed by the C.I.O. Federation of Architects, Engineers, Chemists and Technicians, on grounds that the unit sought in Shell Oil Co., Inc., at Martinez, Calif., is inappropriate for collective bargaining.

Certification of the A. F. of L. boilermakers union for employes in the boilermaking and welding department of Gulf Oil Corp. at Port Arthur, Tex.

Certification of the Refinery Workers Federal Labor Union for production and maintenance employes of Standard Oil Co. of Ohio at Lima, following an election.

Announcement by NLRB that the C.I.O oil workers union had won an election among certain employes in the Breckenridge, Tex., district of Phillips Petroleum Co.

The trend of union organization in the oil industry was shown in figures compiled by the industrial relations branch of the Bureau of Labor Statistics of the Department of Labor. A total of 126,100 were reported employed in the petroleum industry of whom 65 per cent were covered by union agreements in 1945. Of the workers covered by contract, 22 per cent were under agreements providing either that the union be the sole bargaining agent or that its members get preference in hiring; 8 per cent were covered by union-shop contracts and less than 1 per cent by closed-shop agreements requiring the employer to hire through the union.

J. J. Jakosky Elected President of S.E.G.

CHICAGO.—J. J. Jakosky of Los Angeles, on the faculty of University of Southern California and consultant to Union Oil Co. of California, was elected president here this week of the Society of Exploration Geophysicists. Cecil H. Green, Geophysical Service, Inc., Dallas, was elected vice president, and George E. Wagoner, Carter Oil Co., Tulsa, is the new secretary-treasurer. L. L. Nettleton, Gulf Research and Development Co., Pittsburgh, is the holdover editor of society publications.

A special section devoted to the annual meetings of the A.A.P.G., S.E.P.M., and S.E.G. starts on page 67 in this issue. It contains abstracts and excerpts from many of the papers and a summary of the research report.

Wyoming Structures Listed

CASPER, Wyo.—A list of names of geological structures of Wyoming has been prepared by the nomenclature committee of the Wyoming Geological Association and is available at 50 cents a copy from the secretary-treasurer of the association, Box 545, Casper. The list is arranged alphabetically, giving county, township, and range and indicating which structural names are synonymous.

Crude Advance Adds $441,750 to Daily Income of Oil Producers

THE first nation-wide crude oil price increase in nearly 5 years went into effect on Monday of this week on approval of the Office of Price Administration. The change in basic crude prices is exclusive of subsidy payments for stripper production.

The authorized 10-cent increase in the ceiling was first announced March 5 by the price-fixing agency. It lifted the price of 40° and higher gravity crude in Oklahoma and Kansas to $1.35 a barrel, in the Texas Gulf Coast area to $1.58, and in West Texas to $1.22. Based on March 30 production figures, the increase means $441,750 additional income daily to the nation's producers.

OPA officials in Washington earlier had said the increase would be made effective March 29. This date was changed to April 1 after industry representatives pointed out it was in accord with "customary accounting practices."

A flurry of excitement was created in oil circles last Saturday when reports from Washington said the increase had been indefinitely postponed beyond the April 1 date. These reports said the price increase had met opposition of labor groups. Later announcements by the agency made it plain the increase had gone into effect.

Practically all major crude oil purchasers have announced they will meet the 10-cent increase authorized. On advice of legal departments, many companies early this week were awaiting exact information as to number of the OPA bulletin allowing the higher prices before changing their postings.

Granting of the 10-cent raise came after intensive pressure by many segments of the petroleum industry for price relief. A crude oil industry advisory committee which studied the situation for more than a year recommended a much more substantial increase. The committee said the price of crude oil is at about 65 per cent of the parity scale while the general index of all commodities is more than 100.

The 10-cent increase is considered as highly inadequate by many industry representatives. Independent producers have been particularly outspoken, and the campaign for removal of all OPA control from petroleum and its products gained momentum after announcement of the increase.

Continental Oil Co., Standard Oil Co. of California, and Pure Oil Co. early this week announced they had made the increase effective. California Standard said the price for 27° gravity crude at Signal Hill is now $1.25. Another purchaser making an early announcement of a raise in its prices to conform to the OPA action was Nap-Sol Refining Co., Muskegon, Mich.

W.P.R.A. Meeting Ends; Lead Increase Asked

FORT WORTH.—Passage of resolutions urging greater allocation of lead for premium gasoline and condemning Government price fixing in the petroleum industry brought to a close the largest meeting in the history of the Western Petroleum Refiners Association here last week.

Copies of the resolution on the lead supply and a detailed summary of the problem were forwarded to several federal officials in Washington. It said the 3,500-ton allocation for April and further prospective cuts in the allocation for tetraethyl lead will accelerate the rate of vehicle mortality by reducing the quality of fuel and will impose a hardship on refiners, particularly the smaller independents, by damaging their competitive position.

The resolution aimed at Office of Price Administration control was in line with the general industry campaign against all petroleum ceilings. It asserted present controls as creating a "gradual paralysis" of the industry.

Registration at the thirty-fourth annual meeting total 450, said John C. Day, secretary-manager.

Beginning on page 110 of this issue is an article, "New Integral T.C.C. Unit Makes Catalytic Cracking Available to Small Refiners," which is a paper that was presented at last week's meeting of the W.P.R.A. Next week the Journal will publish another of the W.P.R.A. papers, describing the salt-removal program at Ben Franklin refinery, Ardmore, Okla.

Program Announced For Los Angeles Meeting

LOS ANGELES.—A variety of production subjects ranging from core analysis to trends in drilling costs will be discused in papers to be presented at the spring meeting of the American Petroleum Institute's division of production; Pacific Coast district, at the Biltmore Hotel here on April 11-12.

E. H. Moore, United States senator from Oklahoma, will give the main address at the banquet April 11.

Stanolind Moves Offices

Stanolind Oil & Gas Co.'s central division offices will be moved from Tulsa to Oklahoma City effective June 1. Establishment of a manufacturing and natural gas division of the company in Tulsa early this year coupled with a lack of additional office space makes the move necessary, said E. F. Bullard, Stanolind president.

Here are a group of officers of the Western Petroleum Refiners Association which held its thirty-fourth annual meeting last week in Fort Worth. All members of the board of directors, they are, left to right, sitting: W. F. Sims, Panhandle Refining Co.; R. L. Tollett, Cosden Petroleum Co.; R. E. Luton, Ohio Oil Co.; W. E. Moody, Deep Rock Oil Corp.; Reid Brazell, Leonard Refineries, Inc., and W. W. Vandeveer, Allied Oil Co., Inc. Standing: L. B. Simmons, Rock Island Refining Co.; John C. Day, secretary-manager of the association; O. L. Cordell, Bareco Oil Co.; R. R. Irwin, Socony-Vacuum Oil Co., Inc., White Eagle division; H. T. Ashton, Socony-Vacuum Oil Co., Inc., Lubrite division, new president of the association; Roland V. Rodman, Bay Petroleum Co.; H. W. Camp (in front), Cities Service Oil Co.; C. L. Henderson, Vickers Petroleum Co., retiring president; J. W. Warner, Tide Water Associated Oil Co.; and F. H. Dunn, Wilcox Oil Co.

International

NEWS FROM FOREIGN OIL COUNTRIES

Mexico Plans $5,000,000 Drilling Program

MEXICO CITY. — An exploration program embracing the drilling of 13 wildcats and 39 other wells in proved territory at a cost of $5,000,000 has been outlined by Petroleos Mexicanos for 1946.

In a statement on the eighth anniversary of the expropriation of foreign oil properties, Efrain Buenrostro, manager of Petroleos Mexicanos — Pemex, the Government oil monoply —reviewed the accomplishments of the industry in its functioning under Government control and revealed development plans for the immediate future.

He named regions in northern, western, and southern Mexico where oil exploration activities are now under way. They were Ojinaga, Chihuahua; parts of Tamaulipas, Vera Cruz, and Tabasco; northern Chiapas; part of Quintana Roo; the Oaxaco-Puebla - Gerrero region; northwest Nayarit; western Sinaloa; and central Lower California.

Estimating production the current year will be 50,000,000 bbl. compared to 41,000,000 in 1945 and 36,000,000 in 1944, the Pemex head said the company now has 30 drilling outfits, including 22 for deep drilling. The four exploration groups at work in 1940 have been increased to 29 with 100 technicians employed in this phase, he said.

From 1938 through 1940, a total of 55 exploration wells were completed. From 1941 through 1945, the total was 139. The total spent on exploration amounts to $24,400,000, including more than $5,000,000 in 1945.

Proved oil reserves in Mexico, Buenrostro said, are placed at 850,000,000 bbl. Refinery output, which at the time of expropriation was 120,000 bbl. daily, has risen to 167,000 bbl. daily. Of the total refinery production of 36,000,000 in 1945, Buenrostro said 77 per cent was used within the country. The remainder was exported for $88,200,000.

Buenrostro also discussed some of the difficulties which are confronting the nationalized industry. He criticized labor troubles which have plagued Pemex. Particularly, he singled out short sitdown strikes and interunion controversies which impede production and occasionally damage the oil fields themselves. He asked for consideration of the problems of sound financing of the industry's development without Government aid and for understanding on the part of labor.

A less optimistic view of the success of the oil monopoly was taken recently by Manuel A. Hernandez, editor of the magazine El Economista. He placed the loss to Mexico since expropriation at $200,000,000, about half of which represents a decline in value of the industry because of the asserted failure of Pemex to continue finding new reserves while exploiting proved areas.

Wide-Open Russian Methods Costing 20 Per Cent Loss

NEW YORK. — Reports reaching here from Hungary say that Russian engineers are producing about 2,000 bbl. daily above the maximum efficient rate from American - owned properties which they have seized in the Lispe field.

Sources in Budapest asserted the Russian method of accelerating production by permitting the gas to escape into the air will leave about 20 per cent of the annual potential of the field in the ground. Engineers for the Hungarian affiliate of Standard Oil Co. (N. J.) had figured 12,000 bbl. daily was the maximum production under accepted conservation practices. The Russians are reported taking about 14,000 bbl. daily from the area.

Several weeks ago a Budapest dispatch, received here in spite of Soviet consors, placed damage from the alleged wasteful production methods at $25,000,000. Later in New York, Eugene Holman, Jersey Standard president, said the information was in accord with other reports received by the company. He said the State Department is being kept informed but as yet no damage claim has been filed.

The informants in Budapest said the Russians have been wasting enough gas daily to supply Hungary's capital with gas for a week. These methods, they added, are rapidly reducing underground pressures to a point where expensive secondary recovery methods may become necessary.

Lispe contains 153 producing wells. In all, there are 280 wells on a 20-acre spacing in two large and one small fields. Early in January, Paul Ruedemann, Jersey Standard representative, was admitted to the area and attempted to persuade the Russians to reduce output. The Russians refused, reportedly saying Marshal Klementi Y. Voroshilov, Soviet military commander, had told them to "pay no attention to the Americans."

A postwar operating program for the field had been planned to produce a maximum over a period of years. However, in January, F. W. Abrams, Jersey Standard board chairman, pointed out that at no time had the company actually been in possession of its properties.

The international implications of the situation were emphasized by informants in Budapest. One prominent Hungarian, a member of the National Assembly, said he believed all Europe and possibly the whole world is watching the State Department's action in the matter. The dispatch from Budapest which was held up by the Russian censors said the American military mission had sent a note to Marshall Voroshilov calling attention to the company claim that one well had been ruined. However. a U. S. legation spokesman said no word had been received from the State Department concerning the complaint on the Russian methods of production.

Prior to the war Hungary's annual crude production was approximately 10,000 bbl. in 1937; 260,000 bbl. in 1938; 1,000,000 bbl. in 1939; and 1,750,000 bbl. in 1940. The following figures show approximate production from 1941 through 1945:

Year	Barrels
1941	2,954,000
1942	4,655,000
1943	5,866,000
1944	5,670,000
1945	4,550,000

After the below normal demands for petroleum products are met in

Hungary, the Russians take the balance. Prior to the war this annual normal internal demand ran to about 450,000 bbl. of gasoline, 75,000 bbl. of lubricants, 450,000 bbl. of kerosene and over 600,000 bbl. of residual oils. Today Hungary's enforced internal consumption reportedly is only a small percentage of these amounts.

Report Says Much of Europe "Unfavorable"

NEW YORK.—The general outlook for operations throughout large areas of Europe is viewed as "unfavorable" in the annual report of Socony-Vacuum Oil Co., Inc.

In a general summary of the company's far-flung foreign holdings, the report said normal peacetime conditions have not yet been restored, despite the cessation of hostilities. The oil industry in Czechoslovakia, Poland, and Yugoslavia has been nationalized, or a government monopoly established, the report added, and in Rumania and Hungary, the underlying forces are similar.

"In Western Europe, the outlook for our local affiliates is brighter," it said. "In Scandinavia, our companies are operating, and while the threat of government monopoly is present, particularly in Sweden, we expect that we shall be able to continue in business. In France many problems have to be settled. . . . In Italy negotiations with the Italian Government are still continuing for returning to us and other foreign oil companies the properties which in 1942 were sequestered by the Fascists . . ."

Turning to Asia, the report said plans for rehabilitation of company properties in Japanese-occupied area are progressing but are retarded by unsettled political and economic conditions in some countries, particularly the Netherland East Indies. "As soon as possible after V-J day, company employes with special knowledge of local conditions entered these areas to assist the armies of occupation in dealing with petroleum matters," it continued. "Company representatives were in the Philippine Islands as early as April 1945 . . . It should be possible to operate on a private industry basis before the end of 1946 in certain areas, such as the Philippine Islands and China."

China's Oil Studies Completed by Americans

NEW YORK.—Glen M. Ruby, vice president of United Engineering Corp., S.A., has returned to this country after spending about 5 weeks in China where he looked into the possibilities of increasing China's crude-oil production. A. D. Small, chief petroleum engineer for United, who accompanied Ruby, is slated to return in about 3 weeks.

Ruby late last month returned to Chile where he reports that surface pipe for Chile's second well is at hand. This South American country's discovery well came in December 29 of last year and is capable of producing about 2,100 bbl. per day, 29° A.P.I. (Pennsylvania grade crude), according to the latest reports here. The well is in the Spring Hill field, about 6 miles from Puerto Progreso, Tierra del Fuego, Straits of Magellan.

Dr. Gustav Egloff, Universal Oil Products Co., who also went to China to make a preliminary study of China's petroleum refining facilities, is also reported to have returned to the United States.

Shell Companies to Spend $45,000,000 in Venezuela

CARACAS.—In connection with the Shell group's exploratory drilling program in eastern Venezuela—slated to get under way in the second half of this year—and the increase from 14 to 21 drilling strings in western Venezuela, John H. Loudon, president of Caribbean Petroleum Co., states that Shell investments in Venezuela, this year, will be in the neighborhood of Bs. 140,000,000, which is equivalent to about $45,000,000.

The above sum represents capital expenditure only, it was emphasized, and does not include current operating costs.

In connection with plans for the new refinery at Punta Cardon, Paraguana, Loudon said that 400 houses will be built there, as well as transatlantic wharves. A new camp is also slated to be built between Puerto La Cruz and Barcelona with plans calling for 39 houses to be constructed there. The current shortage of pipes and structural steel, in particular, may delay operations, however.

Daily crude production of the Shell group, in Venezuela, is currently about 225,000 bbl., Loudon said.

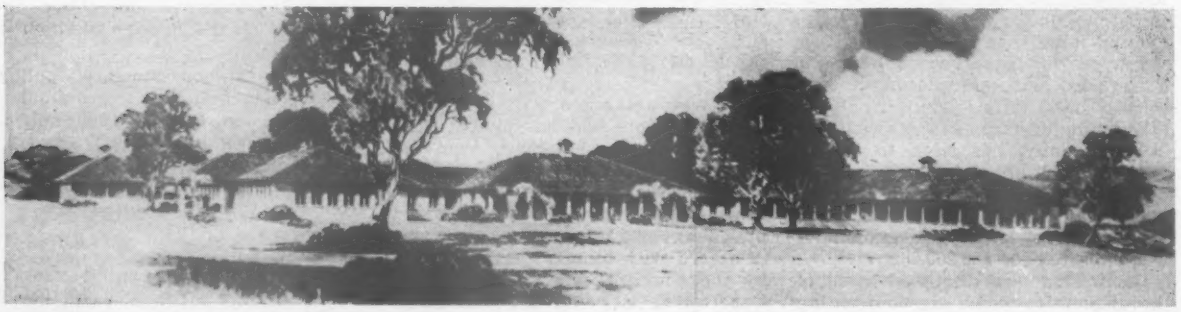
Output of Three Mexican Fields Drops Slightly

WASHINGTON.—Production from three Mexican fields, Poza Rica, Naranjos, and Panuco, in January dropped about 3 per cent from the total in December 1945.

Total output of the fields in January was 3,037,724 bbl. Daily average dropped 3,904 bbl. to 97,991 bbl. in January. Stocks in fields and in terminals in the northern zone totaled 3,992,929 bbl. January 31 against 3,759,758 bbl. December 31.

Argentine Gas Output Down

BUENOS AIRES. — Production of natural gas and of natural gasoline in Argentine during the first 9 months of 1945 declined 6.9 per cent and 15.6 per cent respectively from the corresponding period of 1944. For the 1945 period, natural gas output amounted to 16,649,000,000 cu. ft., while production of natural gasoline totaled 58,818 bbl.



Architect's drawing of a hospital now being built by Cia. Consolidada de Petroleo, a Sinclair Oil Corp. subsidiary, in eastern Venezuela, in the Santa Barbara camp. When completed, it will provide accommodations for 43 beds, an X-ray operating room, physiotherapy, and a staff of 30. Three doctors also will be on the staff

New power rig in the Mene Grande pool, western Venezuela. Vegetation is typical of the area. The field is near the mountains in the flat lands adjacent to Lake Maracaibo

Venezuelan Drilling Expansion Facing Many Obstacles

THERE are approximately 100 rotary drilling rigs in Venezuela capable of drilling development wells or wildcat oil tests. Actually, not all of these rigs are actively engaged in exploitation but some were being employed in the drilling of stratigraphic tests for geologic information.

By the end of the year there could be as many as 135 full-scale rotary rigs at work in Venezuela if all the rigs on order are delivered and put to work without retiring any of the machinery now in operation. Some of the older rigs probably will be retired, depending on the demand and the personnel available for operation.

A prognosis of drilling activity in Venezuela must take into account demand for Venezuelan petroleum. The sustained demand to date has been both surprising and encouraging and there is some hope that other sources of world oil supply may not make the once-feared inroads into Venezuelan markets.

At end of 1945 approximately 25 per cent of the rigs in Venezuela were engaged in wildcat operations and during the present year this figure will jump to 30 per cent and possibly to as much as 35 per cent in the effort to prove up concessions. One company will put into operation a number of rigs designed specifically for portability for the drilling of wildcat and stratigraphic holes. Activity in eastern and western Venezuela will probably continue as it did last year with the increase going to the Guarico area; there appears to be a slight increase ahead for the lowlands in the far eastern part of the country.

With one exception, the larger companies plan to increase drilling activities. The exception contemplates replacing its obsolete with modern rigs and continuing on approximately the same level as at the end of 1945.

Delivery of rigs has been generally on schedule and in most cases they have been on the ground before preparations for putting them into service were complete. Generally new rigs arriving are in the country several months before being put to work. Some of the delay is caused by the lack of a few minor but essential pieces of equipment but chiefly it can be charged to difficulties caused by the personnel shortage. Much of the operating delay is caused by the tardy arrival of supply items and this in turn is due to the slowness with which ships are unloaded at LaGuaria and Guanta (Barcelona).

Expansion from the prewar level of drilling to the present rate has taxed both the foreign and national manpower in Venezuela and to a point where further expansion will call for comprehensive training programs. Further complicating the problem is the changeover from steam-powered to mechanical-powered drilling rigs with the considerable modifications in drilling procedure as well as in personnel organization and training.

"Phillven" camp of Phillips Venezuela Oil Co. in eastern part of the country. Houses for foreign staff are built from native materials with thatched roofs

Idea of Expansion

Some idea of the extent of the expansion can be gained from citing the operations of one company. Shortly before the war began to foreshadow an increase in the demand for Venezuelan oil, this company was operating only 3 of its 15 rigs. Now the same company is operating 18 rigs and before this year ends it hopes to be operating nearly 30 rigs.

The illusion that countries outside the United States have a plentiful labor supply should be dispelled. Much extra personnel is required for the transport of material and supplies and providing necessities for operations often isolated from populated centers. Often the provisioning of crews requires as many men as there are engaged in drilling.

Unemployment is practically nonexistent in Venezuela, leaving a relatively small reservoir of manpower from which to draw personnel to handle expanded drilling activity and the related services. Another obstacle is the reluctance of nationals

(Continued on page 65)

The Advantages of...

FLUID TRANSPORT OF CATALYST AND DIRECT TRANSFER OF HEAT

UOP

Part of a drilling rig in the Llanos area, eastern Venezuela. Mountains in the background are the extension of the Cordilleras across northern Venezuela

(Continued from page 61)

with education to accept employment as skilled or semiskilled workmen. They prefer to become members of clerical staffs.

Expansion of the foreign staff requiring individuals with considerable organizing ability is equally difficult as at the present time employment conditions and wages in the "home" countries are quite favorable to the employe. Finding men with the requisite skills and training for South American assignment is difficult and the number rejected or who resign for one reason or another after only a few weeks or months is remarkably high. At least one-third of those coming to South America fail to stay for duration of their contracts.

Affecting expansion of the foreign and national payrolls is the housing problem owing to the lack of living facilities in towns near oil development. As workmen, both foreign and national, must be provided with housing, a real-estate development must either precede or be concurrent with any development work. This in itself is no small task and one which requires an enormous expenditure of money and manpower. Eventually the building of camps is to become (if it isn't already) one of the major factors in South American operations as the housing requirements are the greatest during the development period and by the time sufficient dwellings are available, the demand has dropped at that particular point but has expanded in a new location more or less distant.

Generally speaking, based on the hourly wage rate the cost in dollars of the labor required to do any particular job in Venezuela is considerably higher than the same work in the United States. And the hourly wage rate is only part of the compensation received by the Venezuelean workman. The cost of housing, medical care, subsidization of some food items, transportation to and from the job and utilidades (bonus paid at the end of the year) must be added to arrive at the true wage.

The manning of the present rigs on order depends on the efficacy of the training programs of the several companies for national workmen and the required expansion of supervisory personnel. The national workman is an apt pupil, and is anxious to learn the correct and the easiest method of performing his job.

The larger oil companies have good training programs but ones which are likewise suffering from being overburdened. The training program is supplemented by (on the other hand it may be considered as the preparation for) further instruction from competent supervisors who know both the language and psychology of the national workmen.

Training Program Behind Schedule

While the training programs of these companies have not failed, they are behind schedule. It is significant that one new rig has been awaiting a crew for over a month and operation must await shutdown of an obsolete rig for release of a crew. There is generally 1 to 2 months' delay in the schedule of putting rigs in operation for all companies. The lag is generally caused by lack of personnel.

Smaller companies have an advantage as the actual number of new employes, national and foreign, is not as great although the percentage may be larger. One of these companies, Phillips Venezuelan Oil Co., has hit on a simple and effective method of training. While awaiting for the larger exploitation rigs to arrive from the United States, Phillips purchased a small rotary rig in Venezuela and used it for training workmen while at the same time drilling water wells for the camp, stratigraphic tests and shallow exploitation holes. As crews are advanced to the larger, more modern rigs, new trainees are recruited.

Another factor which does not hamper the smaller organizations so much is the changeover from steam to power rigs. The newer companies started Venezuelan operations with a fairly high percentage of mechanical rigs. Often it is as difficult to change a "steam driller" into a "power driller" as it is to train a driller originally. Modern power rigs must be handled with more care in actual operation if they are to give good results.

One possibility for smooth expansion of the drilling campaign is being watched closely. This is the use of contractors for doing both wildcat and development drilling in South American fields. A number of United States contractors have considered expansion to South America but only a few have taken positive action.

Although there are three drilling contracting organizations operating in Venezuela at the present time, none is working on a straight contract basis. The three contractors are Parker Drilling Co., Loffland Bros., and Drilling & Exploration Co.

Parker Drilling Co. is operating two steam and two new power rigs, with a third power rig coming from the states, for Venezuelan Atlantic Refining Co. in Eastern Venezuela. These rigs are being operated on a cost-plus basis with Parker furnishing the supervisory personnel and using United States drillers familiar with power rigs to train the national workmen in their operation. All of the rigs are being used on wildcats and semiwildcats.

Loffland Bros. is moving two power rigs into Western Venezuela for Richmond Exploration Co. and likewise these will be operated on a cost-plus basis. If results reveal that wells can be drilled successfully on a straight-contract basis, Loffland may convert to that policy as it has been the company's favorite method of operation in the past. Loffland is furnishing a full staff to drill the wells including welders, truck drivers, and drillers. Richmond has slowed down utilization of its own rigs until success of the contract work can be analyzed.

It is significant that the contractors now engaged in drilling wells in Venezuela are the biggest in the business and therefore have the most capital and the best organizations for this type work. The Parker organization in Eastern Venezuela is headed by J. A. Kelley while Loffland Bros. is headed by Dude Camden assisted by Charley Miller.

Four Given New Posts In M. W. Kellogg Co.

NEW YORK.—H. R. Austin, former executive vice president of M. W. Kellogg Co., has been promoted to the presidency, while M. W. Kellogg has become chairman of the board. F. E. Johnson is the new vice chairman, and L. H. Harvison executive vice president.

Creation of the new executive positions of chairman and vice chairman was necessitated by the proposed expansion program of industrial engineering, manufacturing, and process development, the company said. Plans for widening the base of Kellogg Co.'s operations in the near future, it was explained, provide for extended study of the commercial possibilities of the new processes, equipment and materials developed in connection with Kellogg's work on the atomic bomb project at Oak Ridge, Tenn., as well as utilizing the metallurgical and fabricating advances achieved at the company's plant and laboratories at Jersey City.

Petroleum engineering will continue to play an important part in Kellogg's activities and services to other process industries which will be further extended, officials said.

M. W. KELLOGG

H. R. AUSTIN

F. E. JOHNSON

L. H. HARVISON

Col. Robert H. Ingalls, formerly assistant head of the buying division of Standard Oil Co. of New Jersey, being presented with the Legion of Merit medal by Col. C. L. Hall, division engineer, North Atlantic Division, Corps of Engineers, U. S. Army. The citation set forth that Colonel Ingalls "from June 1941 to March 1944, and from November 1944 to October 1945, actively supported every purchasing activity within the Supply Division and his professional skill and sound judgment were reflected in all those whose work he directed"

Texas A. & M. Planning Reservoir Conference

COLLEGE STATION, Tex.—Plans are being made by the petroleum engineering department of Texas A. & M. College for a conference on reservoir engineering to be held here April 22-26.

The conference will follow a 5-day short course on well-logging methods which attracted more than 175 engineers, geologists, and other industry representatives here March 15, and which was reported in the Journal March 23.

Reservoir engineering subjects on the program fall under 10 different headings, ranging from formation characteristics, through recovery by gas and water injection and cycling operation, to volumetric balance methods. The program will be presented in lecture form, by Park J. Jones, well-known petroleum consultant of Houston. Jones has written extensively for The Oil and Gas Journal, his "Production Mechanics" series of 30 articles being printed in issues November 4, 1944, to June 2, 1945; his "Optimum Rate of Production" series of 25 articles, between September 1, 1945, and February 16, 1946.

Ritchie Defends Treaty in Reply to Landon's Attack

WICHITA.—A. S. Ritchie, member of the executive committee of the Independent Petroleum Association of America, declared here that Alf M. Landon, former Kansas governor, in his recent attack on the Anglo-American oil treaty had "read into the agreement meanings that do not exist."

Kansas independent producers who have taken the time to study the agreement do not share Landon's views, Ritchie said. "Landon attempted to create the impression that adoption of the agreement would result in the complete supervision and management of the American petroleum industry by the proposed international commission," Ritchie said. "Such an interpretation can not be substituted in any manner." Landon at a meeting of the Kansas Oil Men's Association attacked the treaty as endangering the "very existence of the American petroleum industry."

DEATHS

Samuel G. Burk, 61, for 16 years a member of the real estate department of Socony-Vacuum Oil Co., Inc., in New York, died March 26 in Millburn, N. J.

John T. Ravenna, foreman for Hughes Tool Co., died March 27 in Houston.

Fred B. Ely, 66, consulting engineer for many years for Standard Oil Co. (N.J.) and at one time in charge of Amerada Petroleum Corp.'s geological division, died in New York City March 28.

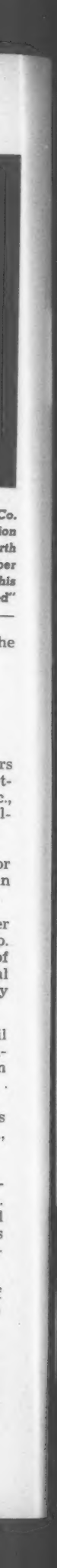
Charles F. Oakes, 72, a retired oil operator and a native of Pennsylvania, died March 27 at his home in Tulsa.

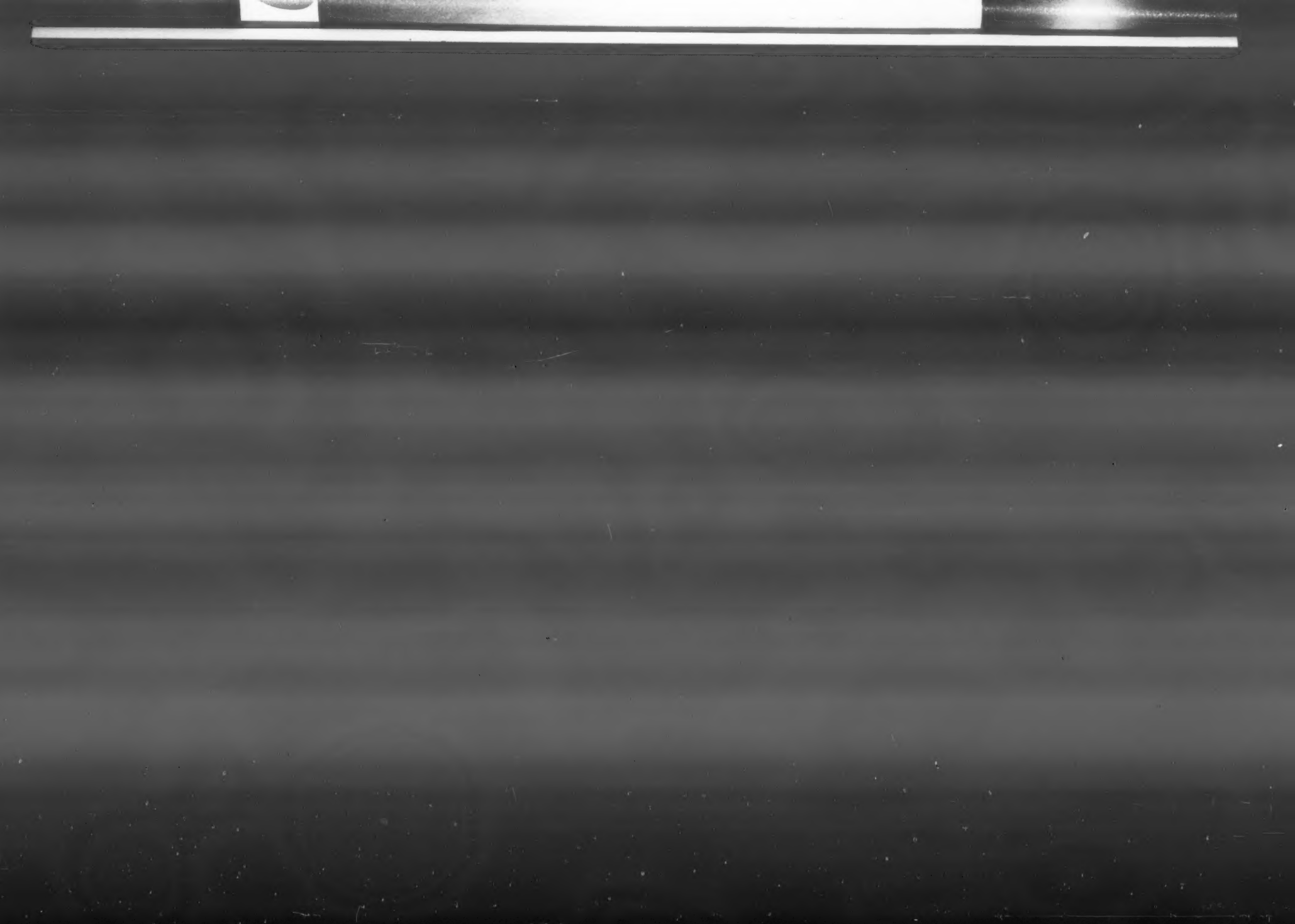
Clark E. Hughes, for many years superintendent of Producers Gas Co., died March 23 in Olean, N. Y.

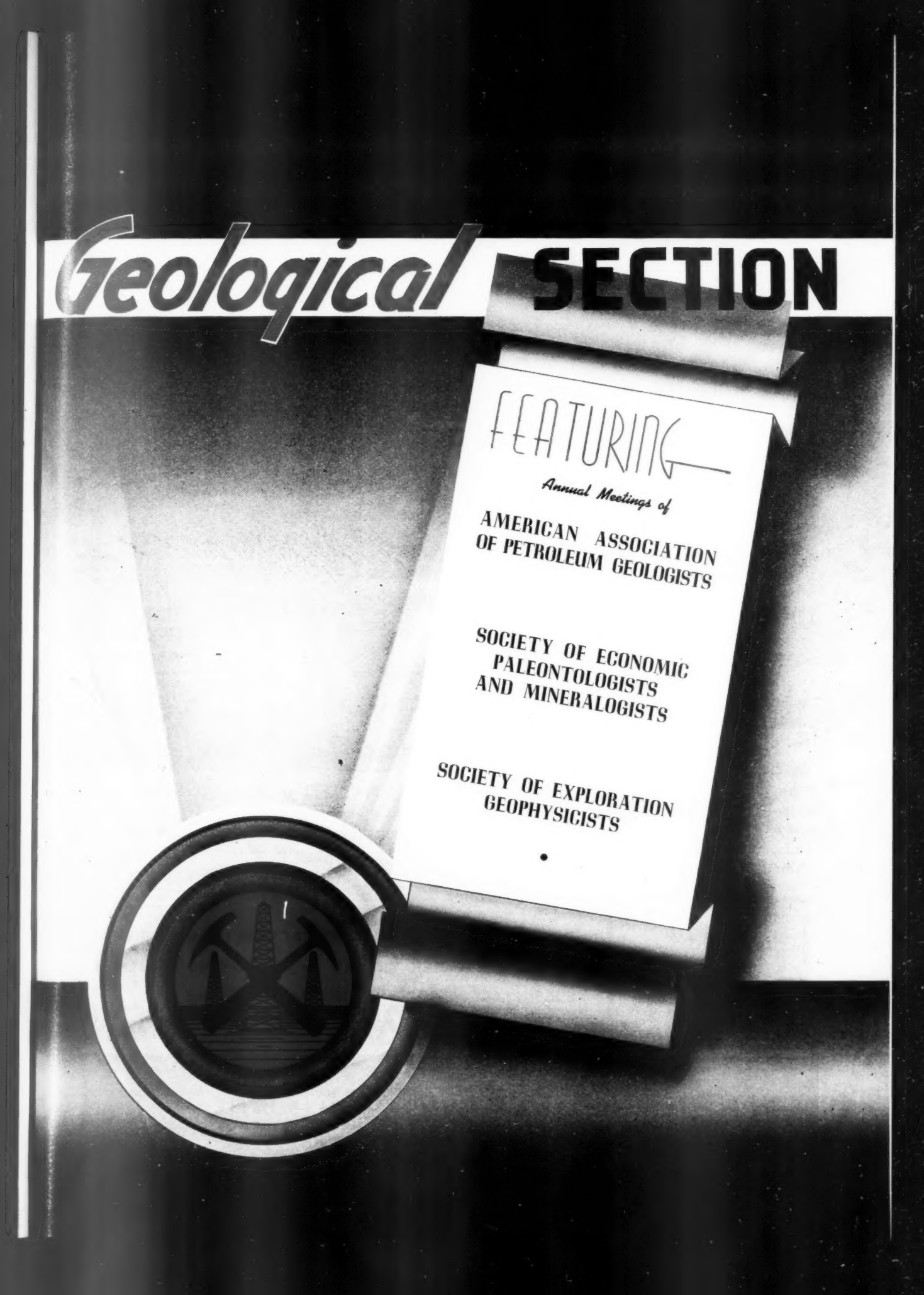
Michael Dougherty, for 50 years associated with Prairie Oil & Gas Co. and prior to his retirement several years ago superintendent of Prairie's tank division, died March 23 in Independence, Kans.

John F. McCool, oil producer of Rew City, Pa., died March 29 in Bradford, Pa.

Edward C. Skaer, 76, Wichita, Kans., oil operator who founded Skaer Oil & Gas Co. and developed the first gas well in Butler County, Kansas, died March 25 in Wichita.



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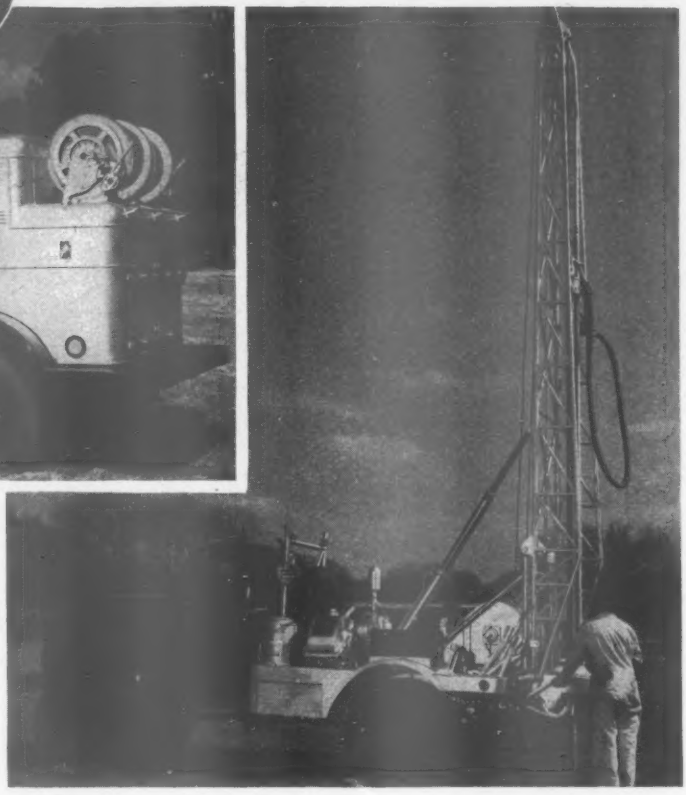

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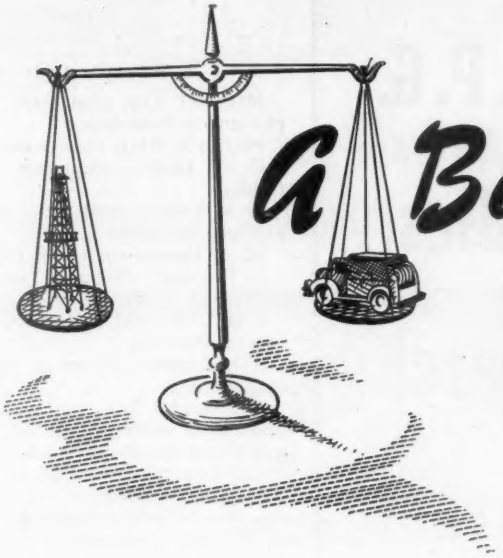

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A.A.P.G. Studies Research Program Problems

by Charles J. Deegan

THE research program, its possibilities, the problems involved, and questions of policy and attitude of the association on the general problem, and individual phases of the subject, were the dominant theme of the annual meeting in Chicago of the American Association of Petroleum Geologists.

Last year the research committee was given an assignment by the association to do two things:

1. To complete a reconnaissance survey of research in petroleum geology and allied sciences with explicit reference to exploration.
2. To formulate a comprehensive research program which the association may adopt as its recommendation for that research most needed to improve ability to find oil.

Even a reconnaissance survey of research into petroleum geology and the allied sciences turned out to be a vast project. When the field was divided into major areas and subcommittees appointed, more than 50 individuals were serving on various subcommittees. Although substantial progress has been made along many lines, many small group conferences held, and voluminous preliminary reports written, the reconnaissance survey is probably only in its initial stage.

The formulation of recommendations as to a policy for the association has necessarily been a constant accompaniment of various phases of the survey, since the assignment of the committee included recommendations for research most needed.

Ambitious Task Presented

This whole research project constitutes what may well be the largest and most complicated task ever attacked by a professional scientific society. A vast amount of virgin territory is involved, both as to the general policy and the specific applications of policy that should be followed by such an organization. Consequently, to some extent, a wide variety of opinions and interpretations on proposals regarding policies not only exists, but is encouraged. This, on the grounds that a wider policy will result, and in the long run, more rapid progress will be made toward the common objective, if there is the initial widespread interest that discussion and apparent differences of opinion usually arouse.

Considerable progress was made in the formal committee sessions and conferences at this meeting, as well as in the private discussions by many individuals. Misconceptions were cleared up, many definitions of terms among disputants reconciled, often eliminating the seeming difference of opinion. Obviously, however, the final policy of the association will be something for the future, since it will clarify slowly as more work is done, and developments indicate that certain courses and policies are more advisable from a practical standpoint.

Some of the problems involved are best illustrated by the following excerpt from a recent memorandum of the chairman of the research committee:

"While we all agree that we want research, the questions of 'How?,' 'What?,' 'When?,' and 'By Whom?' plague every conference. Failure to provide reasonable answers to most of these questions would seriously hamper the construction of a workable research program."

The research committee is attacking these problems along two main lines. First, the committee proper is broken down into subcommittees, with specific fields assigned to them. The organizational setup is as follows:

S. W. Lowman, chairman.

E. R. Atwill, vice chairman, Western United States.

W. P. Hayes, vice chairman, Eastern United States.

Subcommittees

Marshall Kay, chairman, stratigraphy and sedimentation.

Phillip B. King, chairman, tectonics.

G. C. Gester, chairman, reservoir fluids.

J. A. Sharpe, chairman, geophysics and geochemistry.

M. A. Hanna, chairman, projects.

D. P. Olcott, chairman, research facilities.

I. H. Cram and A. I. Levorsen, discovery thinking.

S. E. Buckley, chairman, production engineering.

The second line of attack was devised to overcome the inability to get numerous members together at frequent intervals for discussions about the policy recommendation phase of the committee's assignment. A group of Houston geologists and scientists was formed to meet at a weekly luncheon and discuss matters concerning the role of the association in research. The members of this group are: J. Emery Adams, Arthur P. Allison, Olin G. Bell, Dr. L. W. Blau, O. L. Brace, George S. Buchanan, Donald M. Davis, John S. Ivy, Paul B. Leavenworth, Dr. R. R. Morse, and Paul Weaver.

A summary of the discussions of the group is then mimeographed and sent to all members of the research committee, all past members of the research committee, the executive committee, and to other members of the association who have indicated an interest in the problem. It is hoped that these digests of the discussions will serve as priming material to start similar discussions among the members in the various parts of the country.

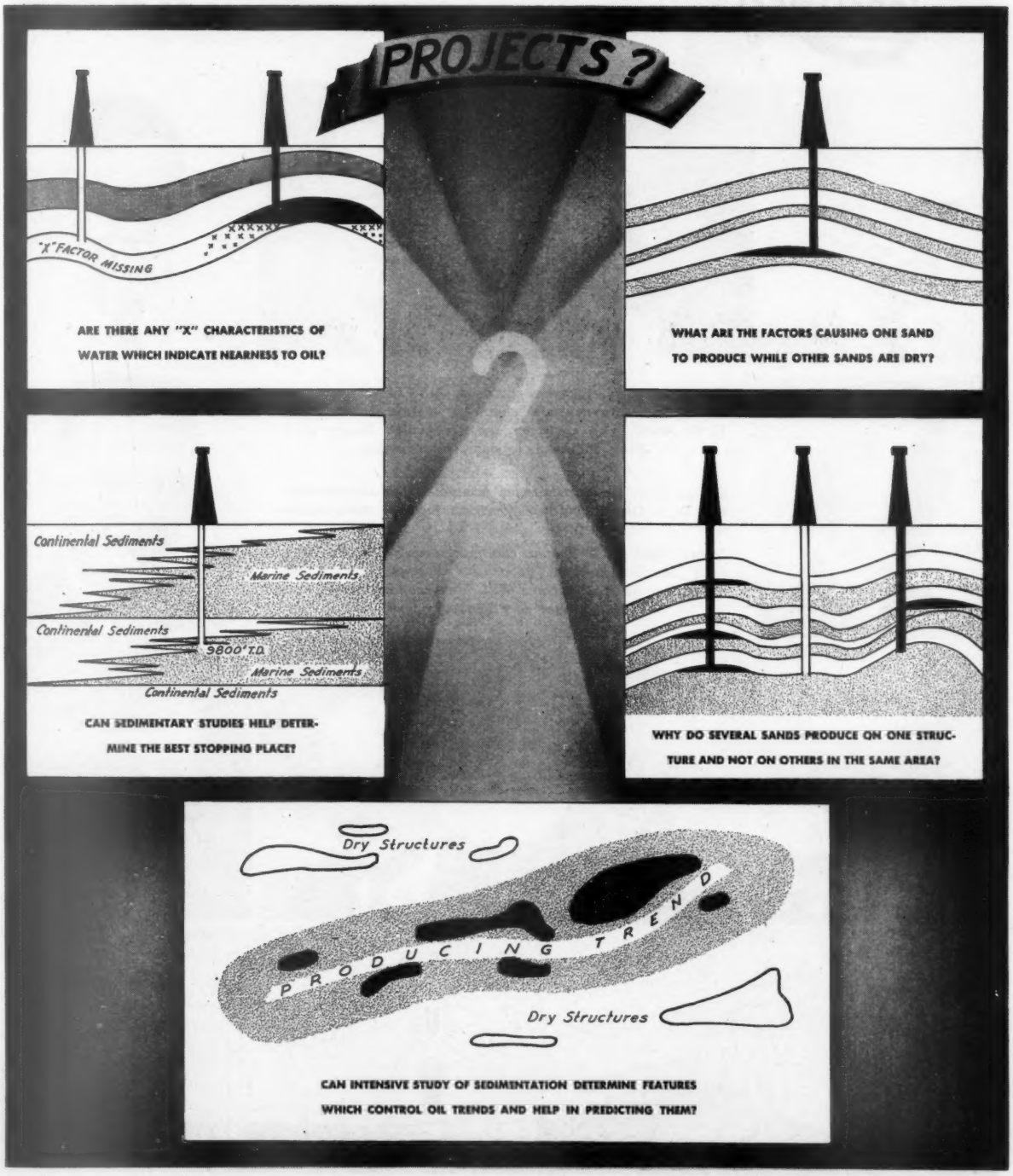
If this idea works out reasonably well, it will serve to maintain a coordinated and organized discussion all over the country, and an interchange of group ideas on common general topics. Out of this work, it is hoped that eventually substantial agreement can be reached on ideas that should be submitted to the association with a recommendation that they be adopted as the official policy of the organization.

With this material as a groundwork, the research committee has held numerous meetings at this convention, beginning on Sunday morning, and lasting all that day, continuing Monday morning and afternoon, and ending with an evening meeting that day.

The volume of work done and the caliber and number of the personnel involved appear to be commensurate with the size of the task, even though that task is probably the largest and most complicated one ever attacked by a professional scientific society.

Everybody WANTS research

BUT HOW? WHAT? WHEN? AND BY WHOM? PLAGUE EVERY CONFERENCE. A WORKABLE PROGRAM MUST PROVIDE THE ANSWERS.


PROJECTS?
"X" FACTOR MISSING
ARE THERE ANY "X" CHARACTERISTICS OF WATER WHICH INDICATE NEARNESS TO OIL?
WHAT ARE THE FACTORS CAUSING ONE SAND TO PRODUCE WHILE OTHER SANDS ARE DRY?
Continental Sediments
Marine Sediments
Continental Sediments
9800' T.D.
Marine Sediments
Continental Sediments
CAN SEDIMENTARY STUDIES HELP DETERMINE THE BEST STOPPING PLACE?
WHY DO SEVERAL SANDS PRODUCE ON ONE STRUCTURE AND NOT ON OTHERS IN THE SAME AREA?
Dry Structures
PRODUCING TREND
Dry Structures
CAN INTENSIVE STUDY OF SEDIMENTATION DETERMINE FEATURES WHICH CONTROL OIL TRENDS AND HELP IN PREDICTING THEM?

Research Program DIVISIONS

SURVEYS & POLICIES

FIND PROBLEMS TO BE SOLVED—

DETERMINE HOW SOLUTIONS ARE TO BE SOUGHT

Top panel: S. W. Lowman, chairman, A.A.P.G. research committee; W. P. Haynes, vice chairman, eastern United States; E. R. Atwill, vice chairman, western United States; P. B. King, chairman, tectonics subcommittee

Center: G. C. Gester, chairman, reservoir fluids subcommittee, and D. P. Olcott, chairman, research facilities subcommittee

Lower panel: M. A. Hanna, chairman, projects subcommittee; J. A. Sharpe, chairman, geophysics and geochemistry subcommittee; Ira H. Cram and A. I. Levorsen, subcommittee on discovery thinking

LOOKING FORWARD

by Eugene Holman

These extracts are from an address by Eugene Holman, president, Standard Oil Co. (New Jersey), to the A.A.P.G. on April 2. Holman has been an active member of the A.A.P.G. since 1920, serving on various committees.

EUGENE HOLMAN

THROUGH several generations the world has become accustomed to look to science for solution of the physical problems of living. But at no time in the past, I think, have people looked so earnestly to science as they do today. Both the obligations and the opportunities facing the scientist are great.

In the field of science in which the interest of this group particularly centers, that of petroleum geology, the task ahead is especially large. Some economists have estimated that in the United States, for example, oil production will average 1½ billion barrels per year over the next 20 years. To end the period with our present reserves undiminished, this means that the industry must find some 30 billion barrels of new oil—a quantity equal to the total production by the domestic industry over the 80 years of its existence.

Continental Possibilities

Large areas of the continental United States remain but sparsely tested for oil. Deeper drilling in present producing areas also affords a vast field for search. But the petroleum geologist will likely have to use to the fullest all his ability for unfettered thinking, imagination and the creation of new concepts of oil occurrence and accumulation. Improved and perhaps new finding tools must come in the future. The challenge thus presented should be an incentive and an inspiration—particularly to the younger geologist who has ahead of him a vast frontier.

The answer is not so much the kind of tools we use but how they are used. Wallace Pratt—a true philosopher of geology—stated this well. He has written:

". . . Three factors combine to make Americans stand out as discoverers and developers of oil in the earth up to the present. These factors are:

"1. A distinctive flair for effective teamwork between science and industry which arises out of the American concept of the dignity of labor.

"2. The freedom from political and social barriers to widespread exploration for oil beneath the surface of the earth in the United States.

"3. The adventurous, chance-taking spirit of the pioneer which pervades America and has impelled Americans to drill thousands of wells every year in search for oil."

Teamwork, freedom, initiative—these are sound arguments. And of these, I suggest, freedom—freedom of opportunity and freedom to exercise initiative—has been the keystone. For without it the others would have been of but little value.

What of the future? The industry's strides in technical achievement over the past several decades justify confidence that, given the same opportunity, there need be no fear for the future in petroleum. We can be confident that just as our geological science has been a living and growing thing, we can count upon future technological developments to continue to bring to use the hidden stores of oil.

Further, we have already assured ourselves against that day, should it ever come, when natural petroleum is no longer to be found in necessary quantities and at reasonable cost. We have, in effect, taken out our own insurance on liquid fuel supply! For the techniques of converting into liquid fuel our natural gas and our tremendous resources of solid fuels are already well advanced. We know that we can—when, as and if necessary—provide the United States with practically unlimited quantities of liquid fuel made from gas, coal and shales at costs which will not be prohibitive.

Certainly, then, the question of our ability to provide for the long future is not "can it be done?" but perhaps "shall we have the opportunity?" Can we insure that our potential will not be made impossible of realization? Here we came to a consideration of social questions.

One which bears directly on industries such as our own is the concept that favors state ownership and operation of natural resources. Oddly, many who advocate this seem to do so in the belief that the centralized authority of the state can find and develop natural resources better than can private citizens. They seem completely to overlook actual history. For our own nation, the greatest exponent of private competitive enterprise, has been overwhelmingly more successful than all those which have practiced various degrees of statism throughout the past 150 years.

Significantly, the basic principle of American democracy—that no group or combination of men are wise enough to direct in detail for the whole—is so firmly a part of our thinking that it is also a cornerstone of successful industrial management. For example, in my own company, extensive and varied operations are carried on by various affiliates. And officers of each affiliate have full responsibility under the coordination and policy guidance of the parent company. This not only develops individual initiative but fosters a spirit of healthy competition—implacable enemies of complacency and stagnation.

Social Engineering

This field of social problems—and what is coming to be called social science—has in the past been marked more often than not by solutions based on emotion rather than on reason. The techniques of the scientific method — the research for fact — so outstandingly successful in the physical side of our civilization have not as yet adequately been applied to our social sphere. Our human engineering has not kept pace with our physical engineering.

In summary, our industry has in the past done an outstanding job in supplying the petroleum needs of our nation and, in substantial measure, of the world. The requirements for the future will be large. But our prospects at home and the fertile fields abroad make it certain that the public need have no concern about ample supply for the years ahead. Improving technology is our assurance.

The geologist must, I believe, look outward in the future beyond his immediate tasks, take greater interest and participation in human affairs and, in effect, be no less than the full rounded citizen that he should be. The scientist of tomorrow must not only create things—he must help to find solutions to problems of their use.

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AND OBTAINING CORE SPECIMENS
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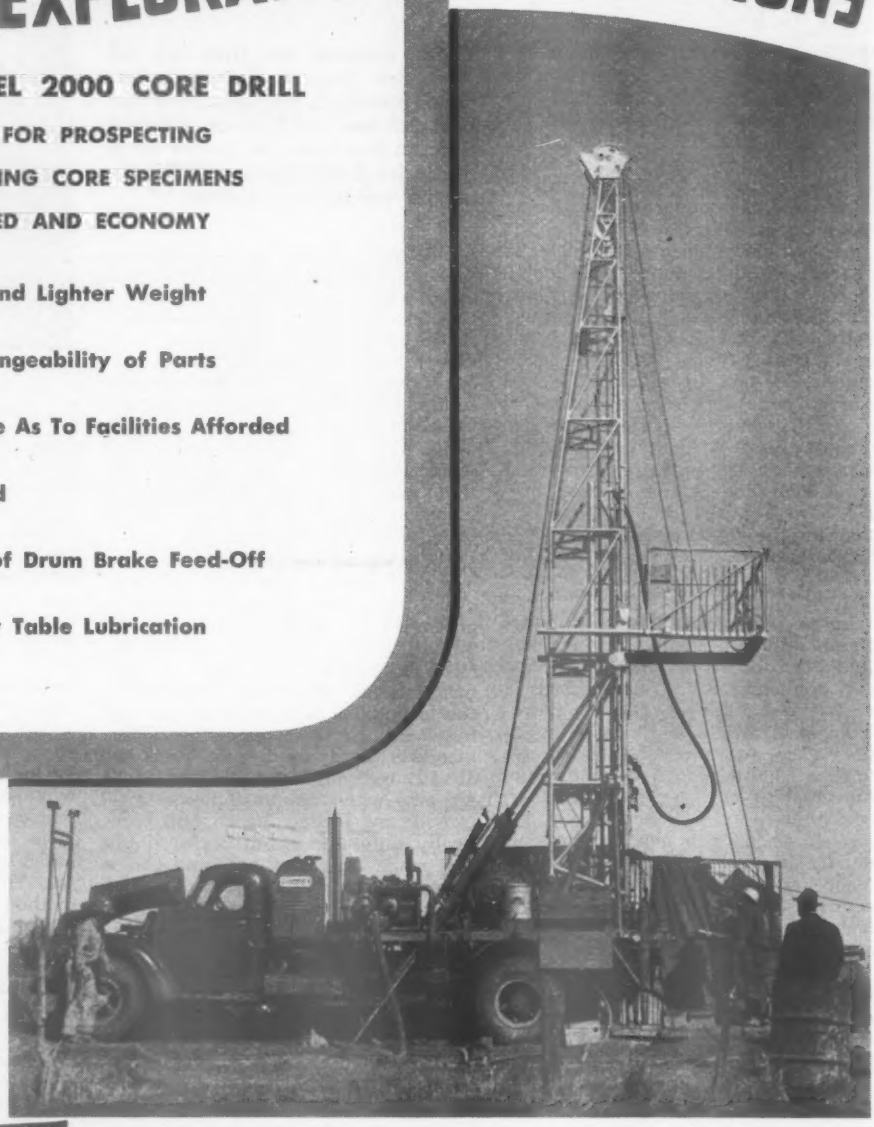

Franks' Model 2000 Drill is a complete truck-mounted rotary drilling unit designed primarily for the purpose of prospecting and obtaining core specimens with greatest speed and economy. Rated capacity is from 2000' of 5½" diameter hole, using 2⅞" O.D. drill pipe, to 2500' to 3000' of 4½" diameter hole, using a 2⅜" O.D. drill pipe (or within the limitations of the drill string employed).

FRANKS MFG. CORP.
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Franks' Model 2000 Core Drill is unusually complete as to facilities afforded, and when furnished with accessories and specialties, includes truck and power plant, power takeoff, power drilling feed, complete pump manifolding including suction and swivel hose, power make-and-break provisions, double drum drawworks, rotary table, swivel, kelly, mud pump, and power-raised derrick-type mast with stacking board.

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In keeping with the policy of most adequately servicing its equipment and as an extension for such service Franks has now established two additional field service points and resident field service men.

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In these areas call Franks Field Service men

Members of the A.A.P.G. executive committee pose for a group picture. The men are: M. G. Cheney, Anzac Oil Corp., president; M. Gordan Gulley, Gulf Oil Corp., vice president; Edward A. Koester, Derby & Bothwell, Inc., secretary-treasurer; Gayle Scott, Texas Christian University, editor, and Ira H. Cram, Pure Oil Co., past president

Three Exploratory Societies Hold First Joint Postwar Meeting in Chicago

CHICAGO.—The first postwar joint annual meeting of the three exploratory societies, the American Association of Petroleum Geologists, the Society of Exploration Geophysicists, and the Society of Economic Paleontologists and Mineralogists, held here this week, was marked by a heavy attendance, and a large volume of committee work, in addition to the technical sessions at which papers were presented.

The technical sessions of the S.E.G. were the first to get under way. In general the papers presented fell into three groups, those dealing with instrumentation, descriptions of practical applications and results obtained as checked by subsequent development in specific fields, and papers dealing with general principles.

Much interest was aroused by Dr. Pirson's paper on geochemistry. This branch of science has been held by many to be potentially a very useful method for exploration. The author's report, reviewing results of over 3,000 measurements of soil ethane emanation rate during a 5-year period, threw a great deal of light on some of the problems that will have to be solved before these hopes can be achieved.

There was disappointment over the forced withdrawal of Dr. Eckhardt's paper on "The Airborne Magnetometer," due to Army security regulations. This and a second paper, covering a method for using a diving bell in gravimeter surveys under water had aroused advance interest. The latter paper attracted considerable discussion, because of the increasing interest in continental-shelf exploration possibilities.

The A.A.P.G. agenda included a heavy load of committee work in addition to the technical and business sessions. A list of these committee sessions is given at the end of this article. Since the research program and questions of research policies on the part of the association were one of the major topics of interest dur-

Earl B. Noble, Union Oil Co. of California, who presided at one of the technical sessions of the A.A.P.G.; F. W. Rolshausen, Humble Oil & Refining Co., new president of the S.E.P.M., and J. J. Jakosky, University of Southern California, and Rev. James B. Macelwane, St. Louis University, nominees for president of the S. E. G.

ing the convention, this subject is covered in a special article elsewhere in this issue.

The technical sessions of the A.A.P.G. fell largely into three groups. There was one session devoted to military applications of geology during the recent war, covering the various theaters of action, and discussing what lessons have been learned, and how the geologist and his training should be used under such circumstances. The session on tectonics was divided into two parts, one in which the general tectonics of regions and areas were discussed, the other in which individual oil fields were treated with emphasis on certain tectonic features involved. The third group of papers were the usual annual reviews by regions of the developments that took place during 1945.

The big feature of the S.E.P.M. technical sessions was the Permian symposium, which included new data on fossils for identification, some tentative correlations of formations, and proposals for subdivisions of series. The emphasis was on the West Texas area. However, the revival of interest in the Atlantic Coast as a possible area for finding oil was indicated by the attention given the paper, "Studies on Macrofossils From Deep Wells Along the Atlantic Coast," by Horace C. Richards, Academy of Natural Sciences, Philadelphia. As a result of the drilling of many deep water wells at Army and Navy camps and bases, as well as wildcats, samples from about 200 wells were available for this study.

Program of Committee Meetings

Sunday Morning

Research committee, S. W. Lowman, chairman. Discussion of policy.

Executive committee, M. G. Cheney, chairman.

Sunday Afternoon

Research committee, S. W. Lowman, chairman. Discussion of policy continued.

Monday Morning

Committee for publication, C. E. Dobbins, chairman.

Committee on applications of geology, J. B. Eby, chairman.

Committee on statistics of exploratory drilling, F. H. Lahee, chairman.

National service committee, F. L. Aurin, chairman.

Distinguished lecture committee, Fred H. Moore, chairman.

Committee on Boy Scouts literature, Max W. Ball, chairman.

Business committee, Robert W. Clark, chairman.

Research committee, S. W. Lowman, leader. Research policy.

Research committee, M. A. Hanna, leader. Research needs in different areas.

Research committee, G. M. Kay, leader. Research needs in stratigraphy and sedimentation.

Monday Afternoon

Business committee, Robert W. Clark, chairman.

Research committee, P. B. King, leader. Research needs in tectonics.

Research committee, G. C. Gester, leader. Research needs in reservoir fluids.

Research committee, J. A. Sharpe, leader. Research needs in geophysics and geochemistry.

Research committee, S. E. Buckley, leader. Coordination of research in petroleum engineering with research in exploration.

Research committee, D. P. Olcott, leader. Research facilities.

Monday Evening

Research committee, S. W. Lowman, chairman. Review of recommended program and recommendation of research policy.

Tuesday

Chemistry subcommittee, A.P.I. research project 43, W. E. Ham, chairman.

Advisory committee, A.P.I. project 43, T. V. Moore, chairman.

Wednesday

Geologic names committee, John G. Bartram, chairman.

National research council commitee, conference on training in geology. Chester R. Longwell, chairman.

Cheney Seeks "Geological Attack" On Problem of Finding Oil

CHICAGO. — Emphasizing the fundamental nature of the science of geology and its part in solving the problems of the postwar era, M. G. Cheney, president of the American Association of Petroleum Geologists, called on the members of the organization to mobilize their efforts for the "geological attack" on the problem of maintaining the discovery rate in oil finding.

Cheney said in part:

"The critical demands of the recent war have demonstrated anew the great importance and innumerable applications of geology. It is my purpose in this address to emphasize the need for greater recognition of the fundamental character and general usefulness of this science to the world at large and to the petroleum industry.

"It is self-evident that the study of this earth is fundamental to the enjoyment thereof. Man strives to understand his origin, control his environment, and shape a better future for his race. Geology, the science of the earth, aids in the attack and solution of a great variety of man's most important problems.

"We are very proud of the great contributions our science made toward the winning of the war. A country lacking adequate petroleum supplies and other essential minerals is soon vanquished. Most of the enormous quantity of minerals which brought quick victory were discovered under the guidance of a few thousand specialists trained in earth sciences. It is doubtful if a greater national service has been rendered by so few specialists in any other field.

"Our profession offers equally great service toward the prevention of war. The wellbeing of a nation, as of an individual, depends in large measure on how it develops and uses its mental and physical heritage. Both the incentive and excuse for aggression by so-called 'have-not' nations should diminish where geology and other sciences are used more fully for both cultural and economic advancement.

Geological Application of Interest

"Our present interest is more directly concerned with the many important applications of geology to the problems of the petroleum industry. The scientific attack is relatively new in the discovery and development of oil fields. The past record is good, but doubtless represents only a fair beginning in our special field. Geological and geophysical techniques of increasing complexity have served to keep discoveries of oil sufficiently large not only to meet greatly expanding demands but to maintain proved reserves around 14 times the current annual rate of production in the United States.

"Interest on investment, ad valorem taxes, and economic uncertainties appear to have generally established this much reserve as a normal supply for the industry. However, this 14-year underground stockpile now appears inadequate because better engineering practices in many

M. G. CHENEY
President, A.A.P.G.

of our major fields prescribe that only 3 to 5 per cent of the ultimate production should be withdrawn each year.

"Thus annual discoveries in the United States well in excess of current oil production rate of 1,600,000,000 bbl. are needed. Fortunately, as pointed out last year by President Cram, the general stratigraphic and structural conditions are such that the hunting ground for oil fields includes 1,600,000 sq. mi. and a still larger number of cubic miles of rock within reach of the drill in the continental United States.

"The 50 billion barrels so far discovered have been located on less than 10,000 sq. mi. Given favorable conditions it seems certain that the high discovery rate essential to national security and welfare can be maintained for many years."

Analysis of Conditions

Cheney then proceeded to outline and discuss in some detail an analysis of what these necessary favorable conditions are, always of course assuming the existence of the requisite healthy economic influence.

The first condition required is more geological data, and he made a plea for more extensive collection of data and more intensive study of that data when collected, as well as more study and reexamination of existing data previously collected. This would naturally call for a larger force of geologists, commensurate with the increase in the volume of oil discoveries required.

The second condition was that there be better application of that data. He called for more critical use of geological information, suggesting that this would accrue from the combined results of initiative on the part of individual geologists, aided by more attention to this phase in the association's publications.

The third condition was that there be more fundamental research. There is a great need for full understanding of the origin, migration, and accumulation of oil, in order to achieve the end result of a successful attack on the problem of finding enough oil at a minimum cost. New concepts and new techniques must be developed.

The fourth condition was that geological information should be so used to contribute to increased development and operating efficiency in fields, once they were discovered. The geologist must pay even more attention to the application of geological information in such manner as to achieve the maximum economic use of the capital funds available for development. Such characteristics as optimum well spacing, position on structure, and physical character of the reservoir are important in determining efficient investment of capital in development work. These all involve geological knowledge.

Henry C. Cortes, president of the Society of Exploration Geophysicists, in his address to the three exploration societies, urged the geologists and geophysicists to assist with management in releasing geophysical case history papers at the earliest possible date, so that publication of the Case History Volume series of the S.E.G. could be initiated with the minimum delay.

John R. Sandidge, retiring president of the Society of Economic Paleontologists and Mineralogists, discussed the growing tendency to recognize the ability of paleontologists and microscopists to render more valuable service than routine examination of well samples. Their background makes them ideal for broader work in the related fields of applied stratigraphy and subsurface geology, and these potentialities are being taken advantage of on a broader scale each year. However, more useful results are still potentially available, if improved facilities are provided and more opportunities are given them for using their talents on other than strictly routine work.

A. A. P. G. ABSTRACTS

Geology of the Maracaibo Basin, Venezuela

F. A. SUTTON, Creole Petroleum Corp., Caracas, Venezuela

THE Maracaibo basin lies mainly in northwestern Venezuela and occupies the V-shaped depression lying between the diverging Andes de Merida and Sierra de Perija. On the southwest it extends slightly into eastern Colombia.

The area of the basin is approximately 23,572 square miles of which 5,000 are covered by Lake Maracaibo, a large body of brackish water whose northern outlet is the Caribbean Sea.

About 85 per cent of the basin floor is covered by the waters of the lake and recent deposits, but the bordering highlands expose a geologic section extending from the pre-Cambrian to Recent. The petroliferous section has an over-all thickness of about 23,000 ft. and extends from the base of the middle Cretaceous to the top of the middle Miocene. Of the 14 formations comprising this sequence all but 2 are commercially productive at one place or another within the basin.

At present there are 13 active fields in the basin. Eight of these are located in Venezuela and five in Colombia. In 1945 the total production for all fields was 221,730,000 bbl., approximately 9 per cent of the reported world's total. As of December 31, 1945, the cumulative total production was 2,634,428,000 bbl.

The Bolivar Coastal field, largest in the basin and one of the world's outstanding oil fields, produced 186,661,000 bbl. during 1945 and as of December 31, 1945, had a total cumulative production of 2,188,339,000 bbl.

Tectonic Maps and Tectonic Provinces of the United States

CHESTER A. LONGWELL, Professor of Geology, Yale University

THE committee on tectonics of the National Research Council, in laying plans for improving the tectonic map of the United States, is considering the following suggestions (1) Correction of errors, and addition of new information as it becomes available; (2) extension of the map into Canada and Mexico as far as reliable information will permit; (3) representation, perhaps in part on auxiliary maps, of superposed structural patterns separated by unconformities; (4) development of symbols and color schemes that may make the map more effective as a wall map, by bringing out major tectonic units more clearly; (5) possible delineation of "tectonic provinces." Differences of opinion will develop in attempting a practical definition of a "tectonic province." Is type of structure, or geologic date of development, the more essential criterion; or must both of these elements be considered? Several provinces are fairly distinctive, on either basis; others are more or less confused. Some tentative and questionable boundaries will be necessary in any representation of the concept on a map. No map can be fully self-explanatory. A treatise to supplement and interpret the tectonic map is a worthy project.

Hawkins Field, Wood County, Texas

E. A. WENDLANDT, T. H. SHELBY, and JOHN BELL, Humble Oil & Refining Co., Tyler, Tex.

THIS paper presents a summary of the history, geology, and development of the Hawkins oil field, southeast Wood County, Texas, from its discovery in December 1940, to September 1945, when regulations of Petroleum Administration for War were rescinded. Active field development followed completion of the discovery well, and although drilling was restricted by war-emergency regulations, 415 oil wells have been completed, producing from the Woodbine formation at an average depth of 4,850 ft.

The Hawkins field occurs on a large northeastward-trending, faulted anticline situated near the north-central part of the East Texas geosynclinal basin. A major fault downthrown to the northwest and trending northeast-southwest crosses the east part of the field. A pronounced gravity minimum indicates that the field is underlain by a deep-seated salt mass. Structural growth increases progressively with depth to the point where the Woodbine producing formation has structural closure approximating 1,200 ft. The Woodbine oil and gas reservoir, which is 5 miles long and 4 miles wide, underlies 8,774 acres. The estimated ultimate recovery from the oil-productive area, which contains 8,372 acres, is 449,717,500 bbl. Cumulative production to September 1945 was 43,134,613 bbl. The oil produced from the field is a predominantly asphaltic mixed-base crude with brownish black color, and the gravity ranges from 16° to 30°. Gas occurs above the Woodbine in the sub-Clarksville sand of the Eagle formation, where porosity is developed.

Extensive coring, and modern development methods, have made possible an intensive study of the reservoir characteristics which may be unparalleled in any other

field. Detailed reservoir information is, therefore, far superior to that available in any other Woodbine field in the East Texas basin. Surface mapping of geologic structure first directed attention to this area, where core-drill information later supplemented and confirmed the earlier surface work. It is noteworthy that up until the time of the discovery of the field, the activities of the principal operator were not influenced by geophysics.

Trends and Developments in Petroleum Production Engineering

STUART E. BUCKLEY, Humble Oil & Refining Co., Houston

THIS paper summarizes the important trends and developments in production engineering, particularly for the period since 1941. This period has had an important influence upon the trend of engineering development because of the fact that the high wartime rates of oil production afforded an opportunity for quantitative observation and evaluation of petroleum reservoir characteristics under controlled conditions.

It is the author's opinion that the most important development in petroleum engineering within recent years has been the inauguration of the transition from the qualitative to the quantitative stage. This transition is not complete but is in fact just sufficiently developed to be reaching the period of vigorous further growth and advancement. The groundwork for this quantitative stage has been built and the future should bring a degree of quantitative engineering control far surpassing expectations of a few years ago. This trend is illustrated with examples of technically controlled development and operation of selected oil reservoirs and the basic and applied research which forms the basis for the trend is briefly reviewed.

The suggestion is made that to keep pace with progress in the industry the technical man, engineer or geologist, must recognize the necessity of abandoning qualitative thinking and must adapt himself to the more difficult task of quantitative study. Those unable to accommodate themselves to this progressive change will lose ground in the same manner that others lost ground in many a manufacturing industry when the processes have advanced from art to science.

Post-Triassic Evolution of a Part of The Atlantic Coastal Region

W. T. THOM, JR., Professor of Geology, Princeton University

THE post-Triassic history of the Long Island-to-Hatteras portion of the Atlantic Coastal Region has been much more complex and interesting than has been supposed—even though more evidence is needed before present tentative conclusions can be adequately tested. However, present indications are that the physical evolution of the northern and central parts of the Atlantic Coastal area during post-Triassic time has progressed through several stages, as follows: (1) Post-Triassic folding and faulting; (2) development of Jurassic gravel-coated plains like those of the present northwestern Great Plains and eastern Rocky Mountain areas—with local hills rising several hundred feet above the bench surfaces; (3) pre-Lower Cretaceous uplift and deep trenching of the Jurassic gravel plains and redevelopment of a trellis drainage pattern in southeastern Pennsylvania and central New Jersey; (4) formation of coarse Lower Cretaceous delta deposits and fluviatile back-fills from the gravels and arkosic waste stripped from the Jurassic surfaces; (5) recurrent regional southeastward tiltings and subsidences coupled with local upwarping along the axes of (still-existent) gravity anticlines, with consequent recurrences of marine transgression and of valley back-fill; (6) recurrent warping and uptilting of most of the present emergent Coastal Region during Pleistocene and post-Pleistocene time.

The Jurassic ancestors of the Hudson, Delaware, Susquehanna, and Potomac drainage systems apparently flowed southeastward and eastward to points beyond the edge of the present Continental shelf. Due to erosional reexcavation and "resurrection," parts of these ancient stream courses have been reoccupied by present-day drainage, northwest of the Fall line. Also due to a progressive compaction of the old valley-fills within the Coastal Plain region some of the smaller modern streams of south-central New Jersey have readopted the lines of this pre-Cretaceous drainage—even though they now flow in a direction reversing that of the original streams.

Tectonic Features of the Greater Antilles

HOWARD A. MEYERHOFF, Executive Secretary, American Association for the Advancement of Science, Washington, D. C.

THE Greater Antilles comprise the northern nonvolcanic segment of an elliptical mountain belt, with the nonvolcanic ranges of Trinidad-Venezuela - Colombia - Panama forming the southern segment, and the volcanic belts of the Lesser Antilles and of Central America closing the eastern and western sides.

The oldest rocks in the West Indies are Jurassic. Although the Jurassic sediments contain some land-derived waste, attempts to establish a pre-Jurassic history have failed. The diastrophic record starts in post-Jurassic-pre-Cretaceous time, and thereafter sedimentation bears a closer relation to the rather localized diastrophic movements than to any decipherable regional pattern. The insular character of the Antilles has been a persistent feature, with the distribution of land areas, seas, and troughs shifting kaleidoscopically with vulcanism in the Cretaceous, and with the shifting sites of diastrophism at the ends of the Cretaceous, Eocene, mid-Miocene, and Pliocene. Major movements still continue, and Quaternary displacements are measurable in thousands of feet.

Antillean structures can best be explained as derivative from primary movements originating in the Andes and transmitted by successive northward thrusts, in part pivotal, across the competent Caribbean floor. Maximum displacement occurred in the west (Cuba), minimum in the east (Puerto Rico, Virgin Islands). Pivotal movement created en echelon fold structures in Mesozoic orogenies and formed the east-west ramp system in Cenozoic time. In the latter, which now controls the distribution of deeps and island landforms, components of force have included compressive, lateral east-west, and vertical elements which, in combination, have acted somewhat fortuitously in space and time.

Geology of the Aliso Canyon Field, Los Angeles County, California

CLAUDE E. LEACH, Tide Water Associated Oil Co.

THE Aliso Canyon field is located in the eastern part of the Santa Susana Mountains, approximately 30 miles northwest from the center of Los Angeles. Oil is produced from the block beneath the folded Santa Susana thrust fault.

The complicated set of structural and stratigraphic conditions pertinent to the accumulation of oil is discussed. The Pliocene, Miocene, and Eocene series each contains a productive zone. Each series is separated from the other by an erosional unconformity with the result that the structure and productive limits of each oil zone are different.

Marine Sedimentary Cycles Of the Tertiary in the Mississippi Embayment

MAX BORNHAUSER, Continental Oil Co., Lafayette, La.

THE principles of marine cyclic deposition are discussed briefly and a classification of marine sedimentary cycles is presented. The principles are applied to the Tertiary section of the Mississippi embayment. Five major marine cycles are differentiated, each representing a major transgression of the sea into this embayment.

Facies and thickness distribution of the older Tertiary cycles indicate the presence of a positive area (submarine plateau) in southeast Mississippi, which is bounded on the north and northwest by negative areas (synclines). Isopach studies also show a progressive expansion of this positive area north and northwest during Eocene time, with a corresponding north and northwestward shifting of the bordering synclinal areas. The theory is advanced that the southeast Mississippi plateau constitutes a part of the northern front of the Gulf of Mexico neutral plate, and that its progressive northward expansion is caused by a gradual rise and possible northwestward drift of this plate in connection with the Tertiary orogenic movements in the Greater Antilles. Epeirogenic movements in the Mississippi embayment and its borderlands are considered to be responsible for the different marine transgressions during the Tertiary. These movements reached a climax at the end of Jackson and during early Oligocene time, after which the sea retreated from the Mississippi embayment. Marine deposition during Miocene time is restricted to the Gulf Coast areas with one minor transgression occurring during the deposition of the Heterostegina zone.

Quaternary Diastrophic Activity On Coastal Plain of Western Gulf of Mexico

W. ARMSTRONG PRICE, Consulting Geologist, Corpus Christi, Tex.

PROGRESSIVE deformation on all classes of structures present characterized Quaternary diastrophism, with all forces recognized continuously active. Deformation has increased under growing sediment load, but seismic shocks have decreased after several thousand feet of soft sediments have been superimposed on the competent pre-Tertiary strata in which they chiefly originate.

Types of deformation include: (1) Regional (formational) tilt; (2) tilt on local sedimentary units, as subdeltas and deltas; (3) rise and tilt on long strike flexures or anticlines, as the Sam Fordyce-Rincon-Agua Dulce-Greta structural zone; (4) growth of faults of extension, as the Balcones, Mexia, and Luling zones; (5) rise of salt horsts even to late Recent, as High Island and Cote Blanche; (6) deep-seated movements, probably gravitational, on buried structures manifested by seismicity. Late movements on faults at surface have resulted in formation of, or growth on, scarps and surface flexures, linear depressions, and opening of fissures and rift lines. Vertical displacements range from maximum values of 3,000 or 4,000 ft. of depression along deltaic coast, 120 ft. on salt "dome" mounds, 45 ft. on fault scarps and depressions, to scarcely perceptible mounding.

Movements recognized are (1) gravitational adjustments: (a) on buried zones of folded and faulted pre-Tertiaries, (b) on unstable mother rock-salt bed of the salt

horsts, (c) in sediments by compaction; (2) crustal yielding: (a) under sediment load, (b) along Mississippi structural trough across foundered Appalachian and Ouachita folded rocks.

To identify and date individual deformations requires (1) shallow subsurface stratigraphic and structural data, mostly lacking; (2) study of detailed and regional geomorphology: (a) on depositional surfaces, well advanced in Louisiana and the Mississippi "embayment," less in Texas; (b) on erosional surfaces, with little critical information. Outlines of geomorphology and structure of region are given, with discussion of methods and character of data. Conclusions are based on a sampling of the voluminous data available, both published and unpublished.

Spectrochemical Sample Logging of Limestones

L. L. SLOSS and S. R. B. COOKE, Montana School of Mines.

VISUAL examination and insoluble-residue analysis have not yielded uniformly satisfactory data for detailed differentiation and correlation of thick and unbroken sequences of carbonate rocks. The method here presented is an attempt to utilize quantitative spectrographic analysis for this purpose.

An external standard method which gave results reproducible within inherent sample error was used. Ca, Mg, Sr, Ba, Al, Ti, Fe, and Si were present in all samples, and Mn and V in some. For practical reasons, S, P, Na, and K, undoubtedly present, could not be determined. The most useful elements appear to be Mg, Fe, Al, and Sr. When analysis of both surface samples and wall cuttings are plotted against stratigraphic interval or well depth, the curves may be interpreted in terms of stratigraphic correlation and differentiation.

Standardization of the method is easy and the results are not dependent on the personal equation. Apart from initial expenditure for equipment, costs and time consumption should be less than those required for foraminiferal and insoluble-residue analysis.

Devonian Stratigraphy in Montana

WILSON W. LAIRD, State Geologist, North Dakota, and LAWRENCE L. SLOSS, Associate Professor of Geology, Montana School of Mines.

AS part of the wartime oil and gas investigation, the Devonian stratigraphy of northwestern and central Montana was studied in detail. Studies were also made of cuttings from deep oil tests on the Sweetgrass arch.

It was found that as far as the surface stratigraphy in northwestern Montana is concerned the strata referred to as the Jefferson formation could be divided into three units, arbitrarily labeled Da, Db, and Dc. The upper unit Da consists of Da_1, an evaporite solution breccia, consisting largely of large clocks of brown dense to saccharoidal dolomite in a matrix of dense and occasionally saccharoidal limestone. The lower part of this unit (Da_2) is coarsely saccharoidal dolomite. On the Sweetgrass arch in the subsurface this unit is represented by an interbedded anhydrite and limestone sequence termed the Potlatch anhydrite.

Unit Db is a dense limestone which apparently is present in Montana except almost everywhere in northwestern and central Montana. Unit Dc is a red shale, "mudstone," sandstone, and shaly dolomite and limestone sequence. In the Lewis and Clarke Range this unit disconformably rests on the Cambrian. In central Montana, this unit is in apparent transition with the Cambrian Dry Creek shale. The significance of this contact is discussed.

In terms of the type section near Logan, Montana, the unit herein designated Db belongs to the limestone member of the Jefferson formation. Units Da_2 and the lower part of Da_1 are correlated with the dolomite member of the Jefferson. The upper part of unit Da_1 is correlated with the Three Forks shale, including the "Sappington" sandstone.

Progress Report on A.P.I. Research Project 43, "The Transformation of Organic Material Into Petroleum"

G. M. KNEBEL, Head of Exploration Division, Standard Oil Co. (N. J.). Work sponsored and financed by the American Petroleum Institute

A BRIEF history of A.P.I. research project 43 is presented, showing its origin as an outgrowth of the Parker Trask project (No. 4). The so-called "Geological Fence," prepared as a guide to the fundamental studies of project 43, is briefly outlined.

Progress and results obtained by the three coordinated subprojects (43-a, b, and c) are summarized, and comments on each are made, pointing to the more important unsolved problems toward the solution of which the future research work of project 43 will be largely directed.

Theories of the origin of oil are discussed, and the need for other research work on the origin of oil, in addition to A.P.I. project 43, is emphasized.

Physical Measurements in Wells for Geologic Data

PAUL WEAVER, Gulf Oil Corp., Houston, and M. T. HIGGS, Lane-Wells Co., Houston.

THE study of drilling reports, cores, and cuttings is recognized as basic in subsurface geological interpretation, and for some years it has also been agreed that additional important geological values can be obtained by measurements of the physical properties of the formations in place in a well. The authors described the various measuring devices now in use for determining some of these physical properties, and the way in which the data measured are interpreted in subsurface work. They also review the present geographical distribution, within the United States, of the use of these devices.

Recent Trends in Geological-Geophysical Exploration and Methods of Improving the Use of Geophysical Data

R. CLARE COFFIN, Stanolind Oil & Gas Co., Tulsa

SINCE 1942 the use of gravimetric methods has increased in the United States approximately 200 per cent, seismic methods 60 per cent, core drilling 100 per cent, and the magnetic investigations 70 per cent. The impact upon geological thinking because of this continued increase of geophysical effort is discussed. Full advantage offered by these methods and combinations of methods is not being made. A better use of the low-cost methods is pointed out. Tremendous increase in the use of the gravity method has not been made with corresponding improvement in the proper understanding of its possible use and its limitations. The use of the gravity method is discussed in some detail. A tremendous improvement in our geological thinking and a better use of geophysical data are possible by an education of district or "grass root" geologists in geophysical concepts and a freer use of this information. A trend in this direction is noted, but the need of an accelerated move in this trend is emphasized.

Subsurface Paleozoic Stratigraphy Of Southeastern Colorado

JOHN C. MAHER, United States Geological Survey, Tulsa

STRATIGRAPHIC investigations designed to assist in the search for oil and gas in western Kansas, eastern Colorado, and parts of the adjacent states were begun in 1943 with the primary objective of correlating the subsurface Paleozoic rocks in these areas with the formations in the oil fields of central Kansas. The results of the investigation in southeastern Colorado are summarized in this paper.

The principal structural features of the area, the Las Animas arch and the Sierra Grande uplift, are discussed in relation to the stratigraphy. Cross sections and distribution maps show Ordovician, Mississippian, Pennsylvanian, and lower Permian beds wedging out southward on the flank of the Sierre Grande uplift.

Relationship of Crude Oils And Stratigraphy in Parts of Oklahoma and Kansas

Tulsa Geological Society Research Committee: L. M. NEUMANN, Chairman, N. W. BASS, R. L. GINTER, S. F. MAUNEY, T. F. NEWMAN, CHARLES RYNIKER, and S. M. SMITH

AN investigation of several hundred analyses of crude oils from several Paleozoic zones, ranging from the upper part of the Arbuckle limestone of Ordovician age to sands of Pennsylvania age in northeastern Oklahoma and southeastern Kansas, shows the following:

1. The oils from 43 pools investigated in the oil-bearing beds associated with the unconformity at the top of the Arbuckle limestone contain 31 classes or varieties of oil, and the oils from 22 pools in the beds associated with the unconformity at the top of the "Mississippi lime" contain 13 classes or varieties of oils; many classes in each of these two zones are represented by only one pool and the other classes by only a few pools.

2. The oils from 34 pools in the Bartlesville sand contain six classes of oil but at least three of the classes are in sand lenses, called Bartlesville, that are of different age and lie at different stratigraphic positions; the oils from 16 pools in the Bartlesville sand, distributed through an area 30 miles long and 12 miles wide, fall in one class.

3. The oils from 33 pools in the Burbank sand, distributed through an area 150 miles long and 1 to 35 miles wide, fall in one class.

4. In Oklahoma each of seven oil-bearing zones younger than the Burbank sand and in Kansas each of four such zones contains a separate class of oil.

5. Each of four pools in the Squirrel (Prue) sand, which is one of the seven zones mentioned under 4, contains a separate class of oil; inasmuch as the Squirrel (Prue) sand represents a series of lenses lying at various positions in a zone about 75 ft. thick, the oil-bearing sands in the four pools probably are not precisely equivalent.

6. In each field wherein oil pools occur in several zones the oil of each zone is unlike the oil in the other zones.

7. The Bartlesville sand and the uppermost beds of the "Mississippi lime" contain similar oil in several pools in a narrow belt of country wherein the sand overlaps the "Mississippi lime."

These facts suggest that the environment of the source material may have determined the kind of oil of each oil pool.

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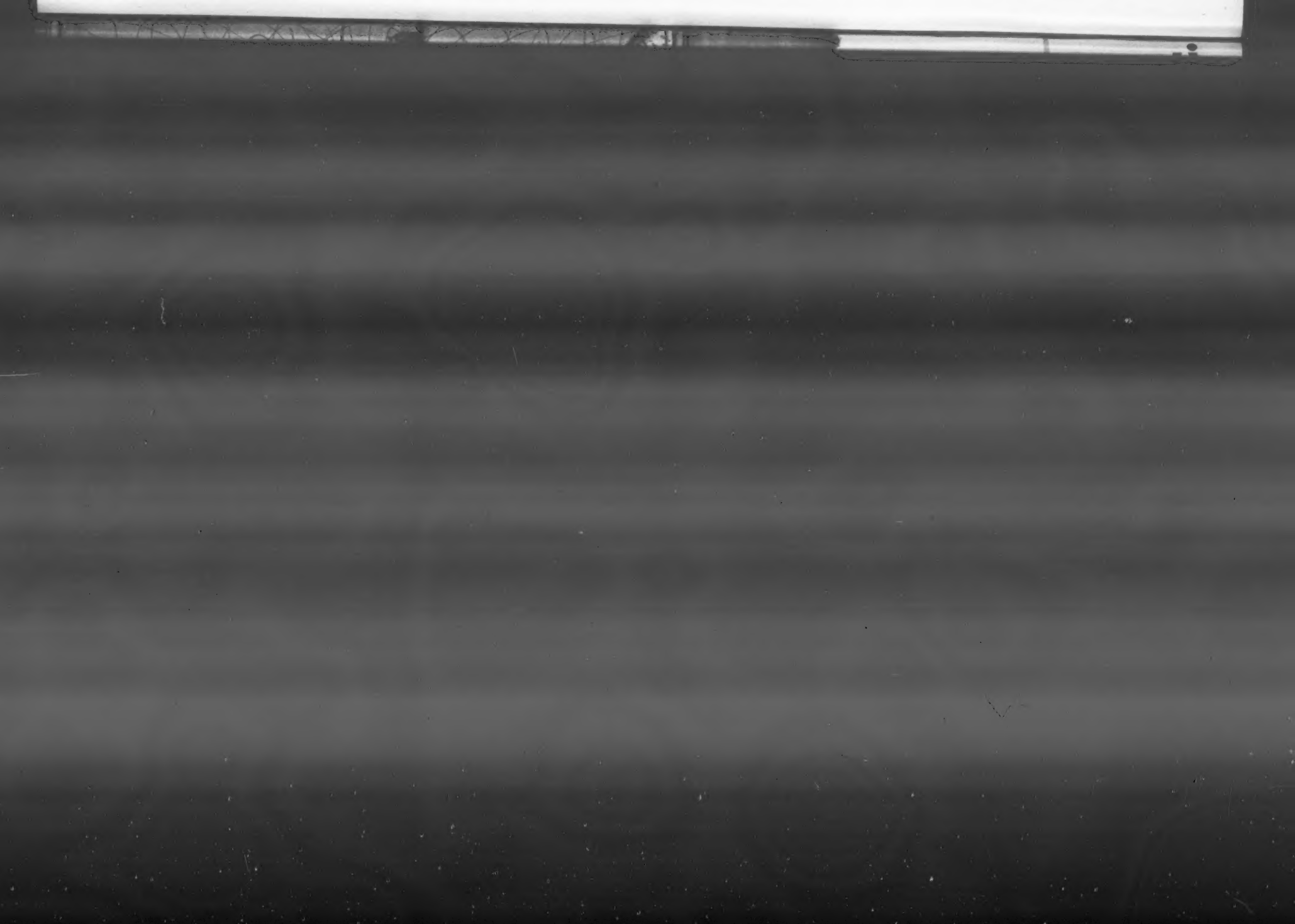

The local environment of beds in contact with the widespread unconformities at the top of the Arbuckle limestone and the top of the "Mississippi lime" would have been most variable; it is these beds that contain the greatest variety of oils. The Burbank sand is confined to a thin stratigraphic zone; it was deposited in a narrow belt along the western shore of the Cherokee Sea and the shoreline can be identified through a total length of about 150 miles. The environment during the time of deposition of the Burbank sand should have been similar all along the shore. It is significant, therefore, that the oil of all oil pools in the Burbank sand lenses of that belt are similar.

Stratigraphy of the Pennsylvanian In the West Half of Colorado And in Adjacent Parts of New Mexico and Utah

LLOYD G. HENBEST, U. S. Geological Survey, Washington.

IN the southern Sangre de Cristo Range, New Mexico, a limestone that has been classed as the lower limestone member of the Sandia formation, Pennsylvanian, and that seemed to be barren of fossils, contains a Mississippian foraminifer characteristic of the Leadville limestone. This lower part of the Sandia is present locally in the Sandia Range and perhaps also in the Sierra Nacimiento, New Mexico. The lithic features of this lower part of the Sandia closely resemble those of the Leadville limestone in the San Juan Mountains, Colorado, and extend the San Juan Mountain facies of the Leadville about 150 miles southeastward.

Pennsylvanian deposition began at many, widely separated localities with clastics on a deeply weathered, uneven surface. The intensely red facies of these basal sediments (Molas formation) is especially characteristic of the sections in the San Juan Mountains and in the subsurface in the oil and gas fields on the south. This facies has also been observed at Glenwood Springs, Colorado, and locally in the Sandia Range, New Mexico. Correlative sediments in northwestern Colorado vary from red to gray and locally include coal-bearing terrestrial beds (lower part of the Morgan formation).

The deposition of the basal clastic sediments was followed by a marine invasion in Morrow time as is indicated by the presence of Morrow Fusulinidae in the following: (1-a) The Glen Eyrie shale member of the Fountain formation at Colorado Springs, and (1-b) the basal Fountain formation on the north; (2) the basal middle Morgan formation of northwestern Colorado and adjacent parts of the Uinta Range, Utah; (3) a part of the Belden shale of Brill at Glenwood Springs, Salida etc.; (4) basal Hermosa formation, subsurface, northwestern New Mexico (but not in the San Juan Mountains on the north where the basal Hermosa is of Lampasas or Atoka age), and (5) Sandia formation in the Sierra Nacimiento and Sandia Range, New Mexico. Marine deposition continued and widened at many of the same localities into Lampasas or Atoka time—the age characterized by the Fusulinella fauna.

Diastrophic Activity, During Historic Time, in the Western Gulf Coastal Plain

MARTIN M. SHEETS, Stanolind Oil & Gas Co., Houston, Tex.

EVIDENCE is at hand to indicate that the western Gulf Coastal plain is at present an area of active structural growth. This paper presents a collection of such evidence. Evidences of structural activity are discussed under six main classes: earthquakes, fissures, faults, regional warps, local subsidence, and psuedo-diastrophic features.

S. E. P. M. ABSTRACTS

Studies on Macrofossils From Deep Wells Along The Atlantic Coast

HORACE G. RICHARDS, Academy of Natural Sciences, Philadelphia.

SAMPLES from about 200 wells along the Atlantic Coast between New Jersey and Georgia have been studied, largely with the aid of a grant from the Geological Society of America. Particular attention has been paid to the mollusks, and an attempt has been made to correlate the subsurface formations of the region. A series of cross sections will be presented as slides. The geographical extent of several formations has been extended.

Since the beginning of the war there has been an increase in the number of wells drilled along the East Coast. The reason is twofold: (1) The construction of many Army and Navy bases and defense plants and the need for additional supplies of ground water, and (2) the increased search for new supplies of petroleum. The

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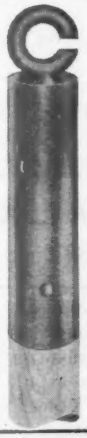

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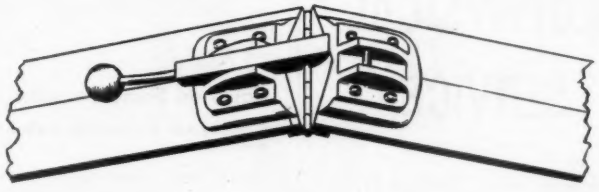

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information obtained from these samples has yielded much new information on the geology of the East Coast, and may have some future economic value in connection with ground water or oil.

Permian Correlations—A Discussion

PHILIP B. KING, U.S.G.S.

THIS paper deals with correlation of the Leonard and Guadalupe series of the Permian, and particularly with correlation of the type sections of these series in the Delaware Basin of West Texas with strata in the shelf areas of New Mexico, Central Texas, and Oklahoma. In 1942, the writer placed the boundary between the two series at the base of the Whitehorse group. Several recently published papers, and some as yet unpublished, present evidence and arguments in favor of a boundary lower than the base of the Whitehorse group. The present discussion is designed, not so much to oppose these recent interpretations as to oppose a point of view typified by the statement that new evidence "disposes of what some geologists regard as problems of correlation." Whatever the solution of the Permian problems may turn out to be, much more work is needed than has yet been done, and the answer will be obtained only by use of multiple, rather than of single, criteria.

New Permian Corals

RAYMOND C. MOORE and RUSSELL M. JEFFORDS, Geological Survey of Kansas

THIS paper makes addition to the known Permian coral fauna of the United States by furnishing results of studies on 19 new species and 1 previously described form. The corals are assigned to 13 genera, of which 1 is new. The studied specimens are derived mostly from Western Texas reef or near-reef limestones of Wolfcampian to Guadalupian age. Five species from shallow-water inland-sea deposits of North Central Texas, Oklahoma, and Kansas, all Wolfcampian, are treated also. It is noteworthy that the coral assemblages of these contrasting environments have little in common.

Notes on Some Permian Algae

J. HARLAN JOHNSON, Colorado School of Mines

THE paper presents a brief resume of our knowledge of American Permian algae. Some studies of Texas material now in progress are mentioned. Of particular interest is the discovery of the genus Gymnocodium which, although widely distributed in the oil world, has not been hitherto recognized in North America. The possibility of using Mizzia and other members of the Dasycladaceae as time (index) fossils is considered.

Correlation of Permian of West Texas and Southeast New Mexico

JOHN W. SKINNER, Humble Oil & Refining Co.

NEW evidence regarding the age of the San Andres formation is presented, and it is correlated with the Cherry Canyon formation of the Delaware Mountains, the upper part of the Word formation of the Glass Mountains, and the "Blaine of Texas" of the Eastern shelf. The Glorieta formation of New Mexico is correlated with the upper part of the Cutoff member of the Bone Spring formation of the Delaware Mountains, the uppermost beds of the Leonard formation of the Glass Mountains, and the "Holt pay" of north-central Ector County, Texas. The San Angelo formation is correlated with the upper part of the Yeso formation of New Mexico, with beds in the upper part of the Leonard formation of the Glass Mountains, and with the middle and lower parts of the Cutoff member of the Bone Spring formation. The Grayburg formation of the subsurface is shown to be equivalent to the lower part of the Queen formation of the Guadalupe Mountains.

Strata of Wolfcamp and Leonard Age in North-Central Texas Region

RAYMOND C. MOORE, Geological Survey of Kansas

FIELD study of the strata of Wolfcamp and Leonard age in the Colorado River Valley, North Central Texas, was undertaken during the fall of 1945. The section in this valley is the most important standard for study of the eastern side of the West Texas basin, because subdivisions that were mainly established here by Drake in 1893 are widely applicable and generally employed in North Central Texas. Primary objects of the recent investigation are remeasurement and graphic representation of exposed strata previously classed as belonging to the Wichita group, determination of major stratigraphic boundaries, review of the classification of subdivisions, and especially acquisition of paleontological and sedimentational data that may be most useful for surface and subsurface correlations.

The base of the strata of Wolfcamp age

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in this region seems most logically to be placed at a disconformity occurring a short distance below the Saddle Creek limestone member of the Harpersville formation. The ammonoid genus, Artinskia, which is regarded as a Permian guide fossil, is found to extend downward to within a few feet of the Saddle Creek. This and other paleontologic evidence, support assignment to the lower Permian of strata above the disconformity mentioned.

The beds of Wolfcamp age of the Colorado River section consist of 900 ft. of alternating shale, sandstone, and limestone. There are persistent red shale zones, and chert is prominent in some of the limestones. Escarpments are strong. The faunas are varied assemblage of normal marine type that lack specialized brachiopods, such as Leptodus and Prorichtofenia, which occur in the type Wolfcamp of trans-Pecos Texas.

Along the Colorado River the overlying strata of Leonard age differ markedly from those just mentioned. Innumerable beds of noncherty bluish limestone alternate with nonred thin shales. Sandstone is lacking. Algal debris and vermicular foraminifera are abundant in the limestones. Faunas are dominantly molluscan. These strata, from shale below the Elm Creek limestone member of the Admiral formation to the top of the Arroyo formation, form a distinctive stratigraphic unit about 1,100 ft. thick. The top of the unit is some 250 ft. higher than the top of the Lueders limestone, or uppermost formation of the Wichita group.

S.E.G. Abstracts

Geology and Geophysics of the Odem Oil Field, San Patricio County, Texas

HOLLAND C. McCARVER and LLOYD G. WEST, Seaboard Oil Co. of Delaware.

THIS paper discusses the successive steps in geological and geophysical exploration that led to the discovery of the Odem field. The original seismograph maps are presented, showing the discovery of structure in an area apparently condemned by dry holes. The remarkably close relationship of seismograph structure to areas subsequently proven productive is illustrated. A geological structure map is presented; also a cross-section comparing seismic and well data.

Geophysical History of the La Gloria Field, Jim Wells and Brooks Counties, Texas

WILLIAM C. WOOLEY, Magnolia Petroleum Co.

THIS paper presents a historical record of the geophysical activity in the area of the La Gloria field.

The successive stages of geophysical exploration were:

1. Torsion balance
   a. Magnolia Petroleum Co. crew, 1934-1935.
2. Seismograph
   a. Correlation reflection seismograph — Independent Exploration Co. crew, 1936.
   b. Dip reflection seismograph—Magnolia Petroleum Co. crew, 1938.
   c. Correlation reflection seismograph — Magnolia Petroleum Co. crew, 1938.
3. Gravity survey
   a. Coastal Oil Finding Co. crew, 1945.

The discovery well, Magnolia's 1 Sam Maun, was drilled and completed in 1938-1939, producing initially 165 bbl. per day of 65° gravity distillate and 5,646,000 cu. ft. of gas through a 5/16-in. choke.

Oil and gas in the La Gloria field are being produced from sands in the Frio formation of Oligocene age. There are a number of sands producing gas distillate. Several flank wells produce oil. The field has been unitized and a recycling plant is engaged in processing the gas distillate.

Dimensions and Units of Electromagnetic Quantities

GLENN J. BAKER, William M. Barrett, Inc.

A BRIEF history is given of the confusion in the literature in regard to c.g.s. electromagnetic units and some inconsistencies are pointed out. It is contended that most geomagnetic measurements are of the flux density B rather than of H, and that the gamma is correctly regarded as equivalent to 10^{-5} gauss. Dimensions of the important electromagnetic relations between m.k.s. units and electromagnetic and electrostatic c.g.s. units are set forth. The adoption of m.k.s. units is urged as they are particularly advantageous to engineers.

Q Meter for Low-Frequency Reactor Measurements

W. R. MITCHELL and F. P. WIPFF, National Geophysical Co., Inc.

A DIRECT reading Q meter is described which permits the determination or Q and inductance over a frequency range of 10-1,000 cycles, and a voltage range of 2-10,000 millivolts. The instrument is par-

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ticularly well adapted to the measurements of reactors and transformers used in geophysical equipment. The theory of operation of the Q meter is given and some of the precautions which must be observed are discussed. The schematic diagram and photographs of the instrument are included and some of the more important constructional details discussed.

A Recording Six-Trace Cathode-Ray Oscillograph

G. L. BEYER, JR., and WARD SHEPARD, JR., Naval Ordnance Laboratory, Washington

A PORTABLE, general-purpose six-trace cathode-ray oscillograph is described. Eight 2-in. cathode-ray tubes are arranged side by side in a line. Six of these tubes have individual d.c. amplifiers which have high gain, high input impedance, good high-frequency response, and excellent stability. The two outside cathode-ray tubes give calibrated timing pulses.

A builtin camera with a fast lens photographs the cathode-ray tubes on standard 35-mm. film, to give a continuous time-displacement recording of the cathode ray spots. The film may be driven past the lens aperture at speeds continuously variable from a few inches per second to 15 ft. per second. A 100-ft. film supply system can be used, or a 10-in. strip can be fastened around the drive drum for short records.

Film can be processed rapidly, and readily examined with a viewer having a 5 to 10-diameter magnification. More complete analysis of records can be made from enlargements.

Seismic Surveys of Neale Field, Beauregard Parish, Louisiana

B. M. CHOATE and O. C. CLIFFORD, JR., Atlantic Refining Co.

REFLECTION-seismic exploration of an area in Beauregard Parish, Louisiana, was initiated in February 1938, and was first completed in October 1938. As a result of shallow structural determination, a test well (dry) was bored. This test was followed by additional seismic work which showed the position of the structure shifted with depth and resulted in the completion of the discovery well in March 1940. Additional seismic data were added at various times, and the area of probable structural closure, to depths in excess of 11,000 ft., was eventually considered evaluated by the method in October 1944.

The Airborne Magnetometer

E. A. ECKHARDT, Gulf Research & Development Co.

THE advent of this new instrument opens up new possibilities in magnetic prospecting. The nature of the information provided by it, and the operating advantages it affords are discussed. Discussion of the instrumentation involved will have to be deferred to a later date.

Geophysical History of Typical Mississippi Salt Domes

L. L. NETTLETON, Gulf Research & Development Co.

THIS paper gives the results of gravity and seismograph exploration of typical shallow domes in the Mississippi salt-dome basin. The domes were first indicated by reconnaissance gravity surveys and were further defined by detailed gravity surveys. Depth and configuration of the cap rock was determined by refraction-seismograph surveys. The geophysical predictions are compared with the findings of subsequent drilling.

Vertical Velocities From Reflection Shooting

L. W. GARDNER, Gulf Research & Development Co.

A METHOD of determining vertical velocities from reflection shooting is described in which a special array of spreads is used by which: (1) Surface correlations are canceled or minimized, and (2) common center points for pairs of long and short setups are used to minimize errors in the determination of angularity corrections. Examples are given in which velocities determined by this method are compared with those obtained from well shooting.

Multiple Refraction Shooting In Southern Florida

LEONARD J. NEUMAN, Consulting Engineer, Houston

IN the multiple refraction method the first arrival of energy of several refracted events are recorded on a single oscillogram. Each of the refracted events usually possesses sufficient character to enable the interpreter to correlate these events for many miles in southern Florida. The subsurface can be profiled continuously. Such refracted events were recorded from several limestones and the crystalline

dolomite. This procedure enables one to determine the velocities, depths, intervals, and dips of these geolgical horizons. The use of nth order refractions would enable one to determine velocities and dips but not accurately to determine the depths and intervals. Velocities of the formations down to 2,000 ft. or more, are very variable in southern Florida. This precludes the possibility of using the ordinary reflection method with any great accuracy, even though reflections may be recorded.

Notes on Shot-Point Procedure

F. J. WILLIAMS, Geophysical Service, Inc.

SOME characteristics of seismic explosives are reviewed, and an attempt is made to outline optimum shot-point procedure from the standpoint of efficiency and quality of data. Care in preparation of charges is stressed, with special emphasis on cap placement and charge assembly.

The time-current relations of a specific seismic cap are given, and the effect of the resistance of the firing circuit upon detonation time is discussed.

Suggestions are made in regard to the choice of the favorable location for the up-hole time seismometer.

It is concluded that adherence to well defined specific shot point procedure is essential to the efficient procurement of highest-quality recordings.

A Geophysical History of the Lovell Lake Oil Field, Jefferson County, Texas

A. P. WENDER, Humble Oil & Refining Co.

BEFORE the advent of geophysics the proximity of Spindle Top to the Lovell Lake area, peculiar topography, and rumored gas seeps prompted the drilling of a number of wells. In 1929 a torsion-balance minimum roughly delineated the present area of the field. Later this minimum was checked by the gravity meter. In 1933 and again in 1935 reflection-seismograph surveys pointed to this locality. Shortly after the discovery well was brought in, a final reflection-seismograph survey defined the Lovell Lake structure rather accurately.

Quantitative Interpretation Of Gravimetric Data

H. L. SCHIFLETT, States Exploration Co.

THIS paper suggests methods of interpreting gravity data gathered in two widely separated provinces. The first area considered is peninsula Florida where little seismic and geological information is available. The second area investigated is part of the Permian Basin in West Texas where, over a period of years, considerable geological and other information has been developed.

Disturbing Factors in Geochemical Prospecting

SYLVAIN J. PIRSON, Pennsylvania State College

A REVIEW of the results of over 3,000 measurements of soil ethane emanation rate made over the past 5 years has revealed a number of conclusions which have an important bearing upon the validity of geochemical methods of prospecting for oil and gas wells. A number of factors have been found to be highly disturbing, namely: earth topography, ground-water percolation and seepage, barometric pressure variations, etc. These effects result in fluctuations of the rate of escape of hydrocarbon accompanied by horizontal shifts of leakage which gives rise to the creation of artificial leakage highs altogether meaningless from the point of view of oil and gas accumulation at depth. Certain qualitative rules of interpretation have been established which permits weeding out of the meaningless anomalies provided sufficient information is at hand on the topography and watertable movement.

A further observation has been made indicating that the artificial anomalies are often of greater magnitude than the significant measurements. Hence the problem, so common in other geophysical methods, of making important reductions on the observed figures is imperiously facing the exploration geochemist if he is to develop a valuable prospecting tool. A serious attempt is presently made to solve this problem.

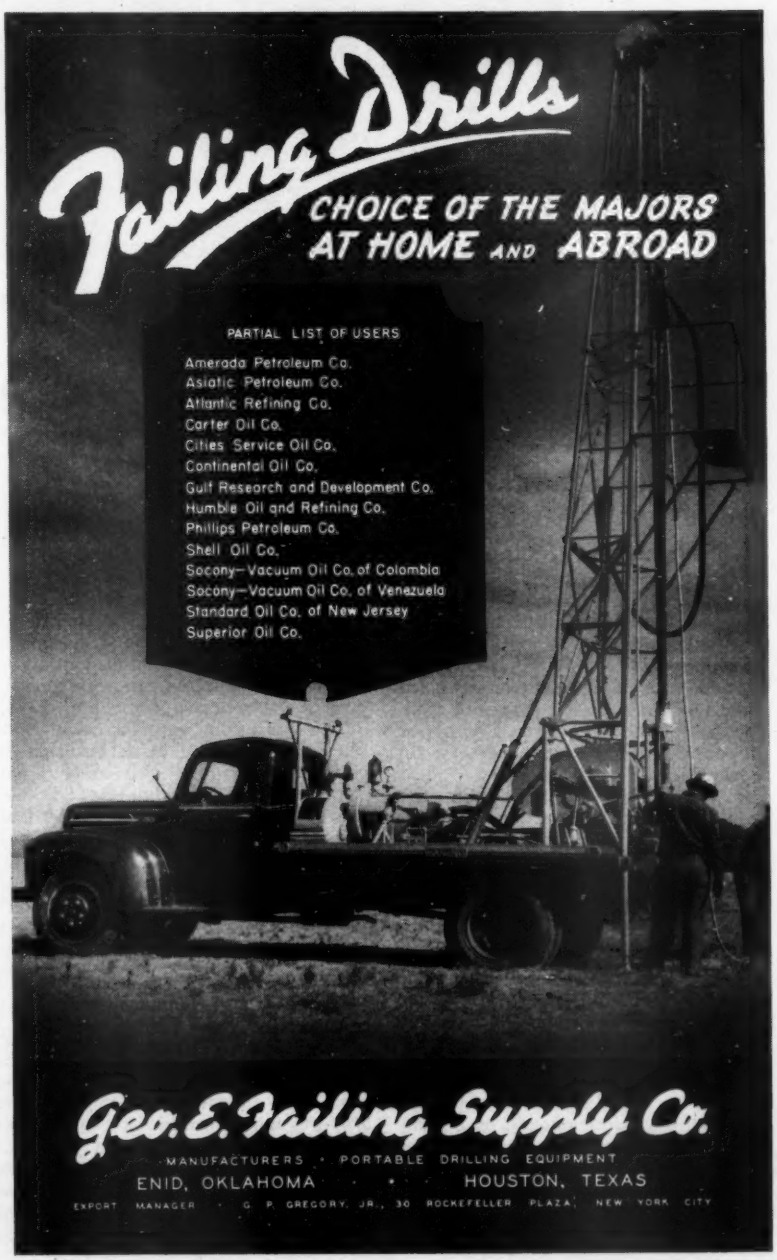
A Diving Bell for Underwater Gravimeter Operation

EUGENE FROWE, Robert H. Ray Co.

THE recent development of diving bell, designed to carry a gravimeter and observer, enables the geophysicist to make direct gravity observations on a river, or ocean floor. The bell, for which patents have been applied, is designed to operate in depths of water as great as 250 ft. It has been used with good results at depths ranging from 8 to 70 ft.

Data taken from adjacent land and sea areas have been contoured and the smoothness of the resulting contours indicates that the under-water gravity readings are entirely reliable.

Structural features of the diving bell and related equipment are described, and plates showing exterior and interior views of the bell are given.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Amerada Petroleum Co.
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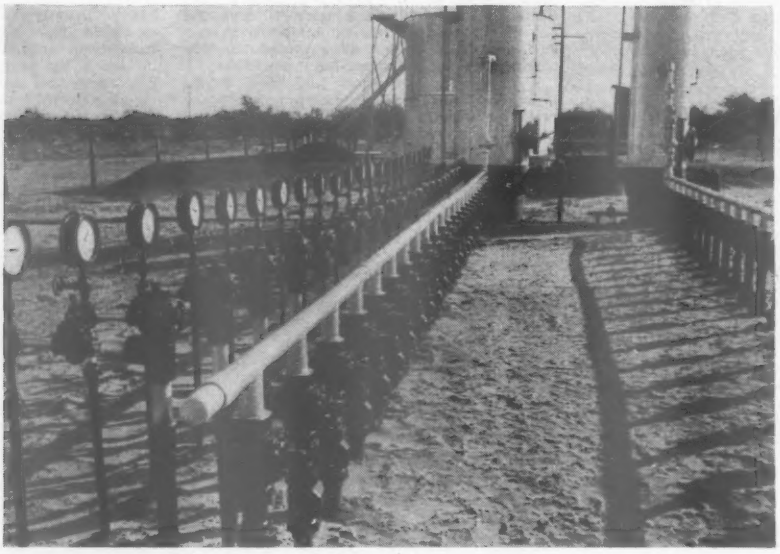
SELECTIVE CONTROL



Centralized choke manifold fully equipped with Thornhill-Craver 10 per cent chokes

Featured in Recent Choke Installations

by E. H. Short, Jr.

THE exigency for greater flexibility in positive choke control has been recognized for some time by engineers associated with this type of production work.

The so-called conventional chokes vary in size increments of 1/64 in., and an extremely high degree of manufacturing skill is required to attain the absolute precision necessary for accurate choke performance.

So while greater selectivity has been regarded as a very desirable improvement in choke control, the problem of designing and producing such chokes, which would require months of costly field experimental work, has been held in abeyance until recently.

Men in actual charge of flow-control work have been confronted with the responsibility of not only making the fractional-sized chokes do the job of producing allowed rates, but also of keeping wells on as consistent flow as possible. However, to approach these requirements, or desirable operating conditions, many different types of choke-improvisations have been resorted to; such as sawed-off and tapped chokes. If such improvisations were successful, the time required for such cut-and-try methods might be fully justified. However, according to the men in the field, during the last few days in the month it is generally necessary either to greatly increase or decrease individual well production in order to arrive at the month's allowable.

The variation in production rates resulting from a 1/64-in. increase in choke size may be extremely great. For example, consider that a well flows 135 bbl. through a 5/64-in. choke. The well's allowed production may be only 95 bbl. per day. However, if the next size smaller fractional choke (4/64-in.) is used, the production, based upon decrease in choke area, would amount to only 67 bbl. per day.

Problem Becomes Pumpers

It would then be the pumper's problem to figure out the maximum number of days the small choke could be used and the number of days the 5/64-in. choke would be required in order to obtain the allowed production with full-month well operation. Or he might attempt to doctor the capacity of one or both of the two sizes of chokes in the hope of accidentally getting approximately 95 bbl. per day. If he elected to use the two sizes of fractional chokes nearest his allowed production (without alteration) he might figure out a simple formula, such as $67X + 135 (31 \text{ days} - X) = 2{,}945$ bbl. allowable for the month. He would then find that he could produce his well at a 67-bbl.-per-day rate for 18.23 days, and at a 135-bbl.-per-day rate for 12.765 days. Ordinarily, a calculation of this kind would be somewhat out of a pumper's line of work.

The use of the two sized chokes giving such a wide difference in daily production has other disadvantages in addition to the one just mentioned. In the case of some wells, the sudden doubling of the daily production rate might, over a period of time, be responsible for trouble and expense due to pulling in water and sand.

The example given illustrates the wide variation in production rates encountered in only two sizes of fractional chokes. A large number of flowing wells on the Gulf Coast are on chokes varying from 1/64 in. to ⅛ in., and in this range of fractional sizes there are only eight steps, or

(Continued on Page 126)

Chokes, sizes — Fractional type chokes	Chokes, sizes — New "10%" chokes	Bbl. per day — New "10%" chokes	Bbl. per day — Fractional type chokes
1/64-in.			10.00
	X1	36.4	.....
2/64-in.	*X2	40.00	40.00
	X3	44.00	.....
	X4	48.4	.....
	X5	53.24	.....
	X6	58.56	.....
	X7	64.41	.....
	X8	70.85	.....
	X9	77.93	.....
	X10	85.72	.....
3/64-in.			90.00
	X11	94.29	.....
	X12	103.71	.....
	X13	114.08	.....
	X14	125.48	.....
	X15	138.02	.....
	X16	151.82	.....
4/64-in.			160.00
	X17	167.00	.....
	X18	183.70	.....
	X19	202.07	.....
	X20	222.27	.....
	X21	244.49	.....
5/64-in.			250.00
	X22	268.93	.....
	X23	295.82	.....
	X24	325.40	.....
	X25	357.94	.....
6/64-in.			360.00
	X26	393.73	.....
	X27	433.10	.....
	X28	476.41	.....
7/64-in.			490.00
	X29	524.05	.....
	X30	576.45	.....
	X31	634.09	.....
8/64-in.			640.00

*Corresponds approximately to 2/64-in. choke.

Fig. 1—Theoretical consideration of flow rate on a given well, through use of chokes up to ⅛ in. Selectivity of production rates obtainable with "10%" chokes compared with fractional chokes. In addition to the 31 sizes of X chokes shown above, there are 29 more X chokes in the fractional range from ⅛ to ½ in.

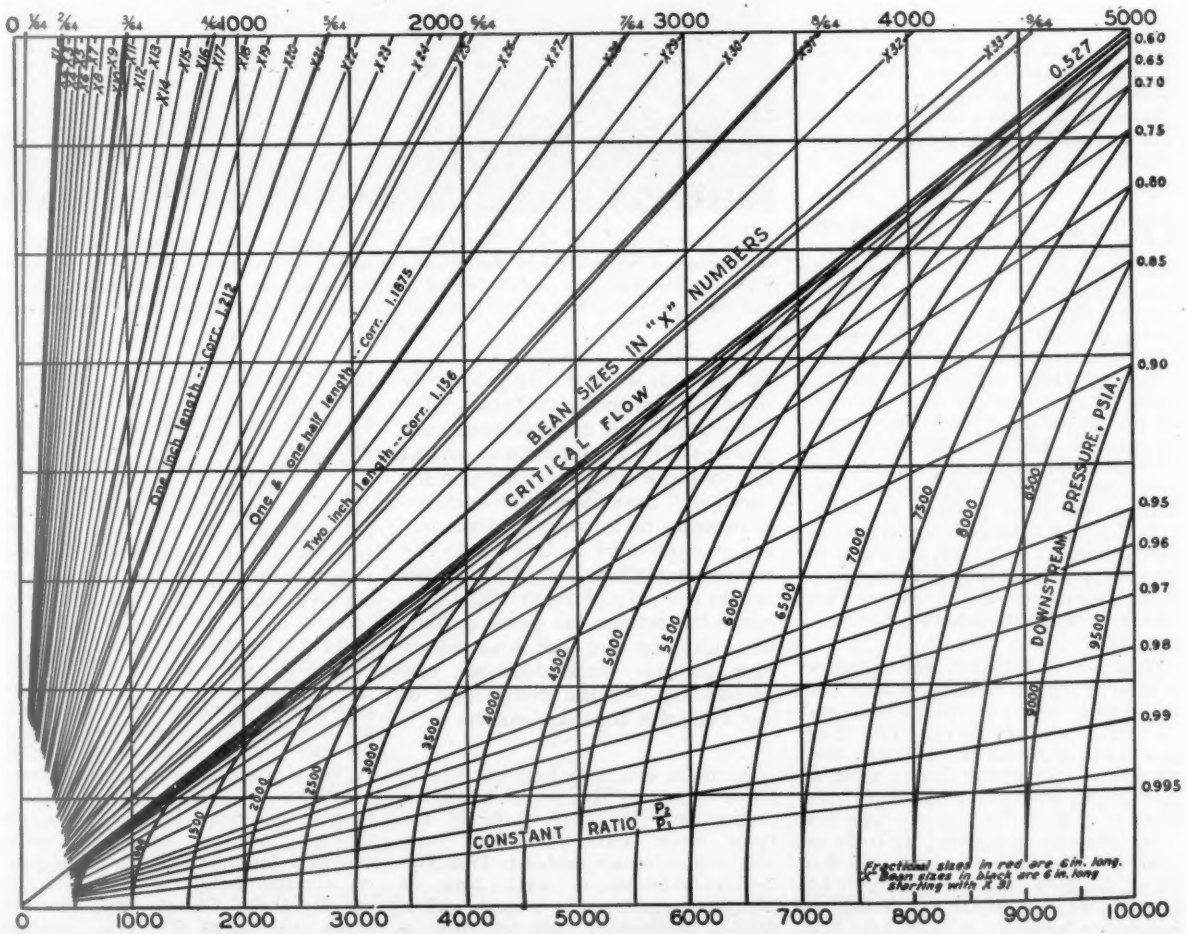

BEAN SIZES IN "X" NUMBERS
CRITICAL FLOW
One inch length -- Corr. 1.212
One & one half length -- Corr. 1.1875
Two inch length -- Corr. 1.158
0.527
CONSTANT RATIO P2/P1
DOWNSTREAM PRESSURE, PSIA.
Fractional sizes in red are 6 in. long.
X Bean sizes in black are 6 in. long
Starting with X 31

Fig. 2—Gas flow chart for calculating flow through chokes up to 9/64 in. The rates of flow possible through fractional chokes is represented by red lines. The flow through the 10 per cent chokes is represented by black lines

Oklahoma's First Triple-Zone Completion

by Neil Williams

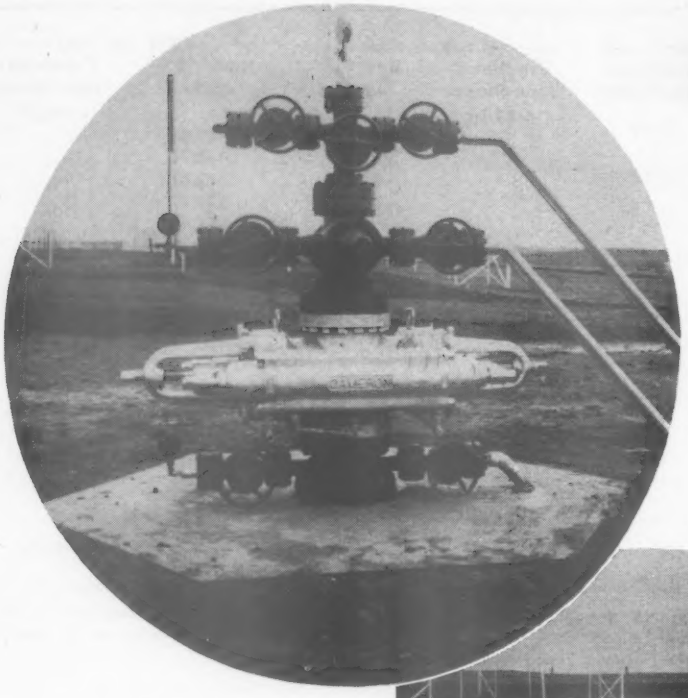


Fig. 1—Surface hookup of Chickasha triple-completed well. Bottom zone (Mona sand) is produced through tubing (top outlet); middle zone (Charlson sand) through the 5½-in. casing (middle outlet), and the upper zone (Glover sand) through the 8⅝-in. casing (bottom outlet)

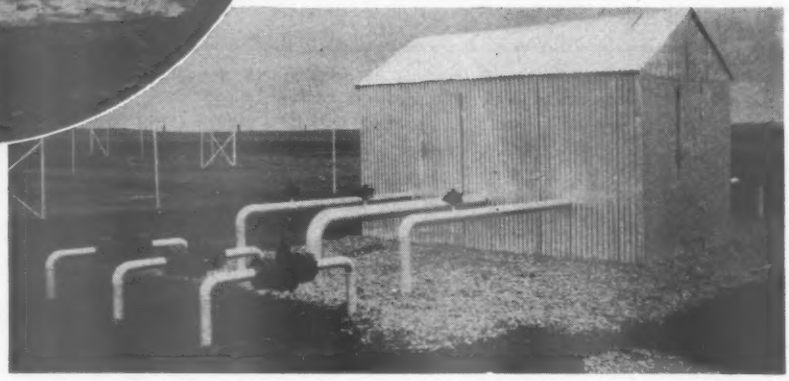


Fig. 2—Meter run installation. Flow lines for the respective three producing zones rise to the surface (foreground) and then pass downward to the inlets to the drips (buried). Risers to the meter runs (meters located in the housing) are from the drip outlets. Center run (for Mona production) is 6-in. Outer runs (for Glover and Charlson sands, respectively) are 4-in.

OKLAHOMA'S first well to be produced from three different horizons separately and simultaneously was completed recently by Oklahoma Natural Gas Co. in the Chickasha gas field, in Grady County. As one of the comparatively few wells anywhere in which triple completion has been entirely successful, an account of the procedure followed is of timely interest. Effectiveness of the procedure in segregating the three horizons under fairly high-pressure conditions has been attested to by the fact that since completion no leakage across packers has been apparent. No trouble was experienced at any stage of the operation, and at no time was the well without adequate means of control.

The well (1-B Duke) was drilled to a total depth of 6,351 ft., where 8⅝-in. casing was run to bottom and cemented with 800 sacks. The three gas sands involved in the triple completion are: First, the Glover sand, in two zones, at 5,140 to 5,170 ft. and 5,180 to 5,190 ft.; second the Charlson sand, also in two zones, at 5,420 to 5,440 ft. and 5,460 to 5,560 ft., and third, the Mona sand at 6,315 to 6,345 ft. The upper two sands are regular producing horizons in the field. The Mona sand is a new horizon previously unproductive.

So far, only a relatively few wells, most of them in South Texas, have been completed as triple-zone completions. The complications arising in segregating three horizons in the same well bore have been such until recently as to prevent more general completions of this kind. The triple completion described in this article not only is the first for Oklahoma but reflects the developments in equipment and technique adaptable for this work. Methods employed insured the completion of the well with ease and safety.

Before it was definitely decided to triple complete the well, individual production tests were made of the three sands. First, the Mona zone was perforated six shots per foot. The test resulted in an open flow of 20,000,000 cu. ft. of gas daily and a shut-in pressure of 1,950 psi. Next, a mechanical plug was set at 5,675 ft. and 75 ft. of cement spotted on top to shut off the Mona zone and permit testing the upper two sands. The first Glover zone (5,140-70 ft.) then was perforated with six shots per foot, tested, and then acidized for a second test, which failed to show any increase in open flow. After this, the second Glover zone (5,180-90 ft.) was perforated with six shots per foot and tested. Both Glover zones then were acidized together and retested. After producing for several days, although there was no apparent benefit at first, the volume increased materially. Following this, the entire Charlson section was perforated with six shots per foot and the well allowed to clean up with both zones producing together for a preliminary completion test.

Results obtained were such that it then was decided to triple complete the well, thereby making all zones available for production independently. Consequently, the well, producing from the Glover and Charlson sands, was killed with mud, and the cement and mechanical plug drilled out to open the Mona sand. Equip-

ment assembled for the completion consisted of, in addition to the Cameron well head and blowout-preventer equipment already on the well, a string of 5½-in. casing, a string of 2½-in. upset tubing, one 5½ by 8⅝-in. Cameron circulating anchor packer, one 5½ by 8⅝-in. Brown Oil Tool full-opening packer, one 2½ by 5½-in. Cameron Type K packer, and a 2½-in. Otis side-door choke. The plan called for producing the Mona sand through the 2½-in. tubing, the Charlson sand (intermediate zone) through the 5½-in. casing, and the Glover sand through the 8⅝-in. casing.

Since the 8⅝-in. casing had been set in slips in the 13-in. head which was made up on the surface casing, a safety flange was placed on top the 13-in. head and the 8⅝-in. casing welded to this flange. A Cameron L.D. head with two openings then was placed on top the safety flange, and on the head two Cameron blowout preventers, equipped with rams to fit the 5½-in. casing, were assembled, one on top of the other.

The next step was to run the 5½-in. casing. The make-up of this string (Fig. 3), starting from bottom and measured with steel line from zero depth (9 ft. above the 13-in. safety flange) was:

Casing make-up—	Feet
Plain	4.7
Perforated (drilled ⅝-in. holes, 6/ft.)*	20.0
Plain	66.2
Center of seal on Cameron 5½-in. packer	7.0
Seal center to top of packer	2.1
Total from bottom to top of packer (at 6,247 ft)	100.1
Plain	663.04
Perforated (drilled ⅜-in. holes, 6/ft.)†	59.45
Plain	31.15
Perforated (drilled ⅜-in. holes, 6/ft.)†	30.30
Plain	249.22
Total to bottom Brown 5½-in. packer	1,133.16
Brown packer	4.75
Total to top of packer (at 5,209 ft.)	1,137.91
Plain	5,209.40
Total to safety flange—and welded	6,347.31

*Opposite Mona sand. †Opposite Charlson sand.

An extra heavy collar was placed on top of the 5½-in. casing to rest on the rams in the bottom blowout preventer. A 20-in. joint was screwed into the collar and the casing set down slowly until enough weight was placed on the lower packer to shear the pins in the packer, so that when the 5½-in. casing was finally set down the packer would seat readily and seal the annulus between the 5½-in. and 8⅝-in. casing to separate the Mona from the Charlson sand. With this done, the string was raised approximately 5 ft. off bottom, opening the packer. The 20-in. joint on top then was replaced with a pup joint and the upper blowout preventer equipped with 2½-in. rams to run the tubing.

Makeup of the 2½-in. tubing string (Fig. 3), starting at 6,247 ft. (bottom) was:

Make-up—	Feet
Upset tubing (with pin in collar 6 ft. from bottom)	592.53
Cameron 2½-in. packer	6.20
Total to top of packer (at 5,648 ft.)	598.73
Upset tubing	62.35
Total to bottom of Otis choke	661.08
Otis choke	2.30
Total to top of Otis choke (at 5,584 ft.)	663.38
Upset tubing	5,586.70
Total to safety flange (screwed)	6,250.08

When the tubing was run, the blowout preventer on the 5½-in. casing was removed and a 5½-in. head placed on the string, leaving the 13-in. preventer to become a part of the permanent well-head assembly. The tubing then was set in slips on the new 5½-in. head and packed off with a rubber ring so that all strings would be gas tight. At this point both the 5½-in. casing and the 2½-in. tubing were suspended off bottom. Since a comparatively light Cardwell unit had been moved in to complete the well, and since both strings would have to be lowered together to seat the packers for isolating the Glover sand from the other two zones, hydraulic jacks were placed on the 5½-in. casing to lower this string.

From a nearby source, 1,450-psi. gas pressure was available to help clean the well and bring in the sands. The first zone to be brought in was the Glover sand since it was to be produced through the 8⅝-in. casing. To utilize the available gas pressure, a gas connection was made to one of the two 8⅝-in. casing outlets, another to one of the 5½-in. casing outlets, and a third to one of the 2½-in. tubing outlets, with valves on each connection. Mud-line connections from the opposite outlets in each case were so arranged that mud could be forced out of each string individually, or any two strings together.

First, the valves on the 2½-in. tubing and 5½-in. casing mud outlet lines were opened, leaving the 8⅝-in. casing mud-outlet line closed. With packers separating the individual zones still open, permitting circulation, gas then was turned into the 8⅝-in. casing. Initially just enough pressure was admitted to flow the mud from the 5½-in. and 2½-in. strings. Pressure then was increased gradually until all the mud that could be forced from the well with the available 1,450 psi. was removed. With this done, the valves on the 5½-in. casing and 2½-in. tubing mud-outlet lines and the 8⅝-in. casing gas-inlet connection were closed, and the mud-outlet valve on the 8⅝-in. casing was

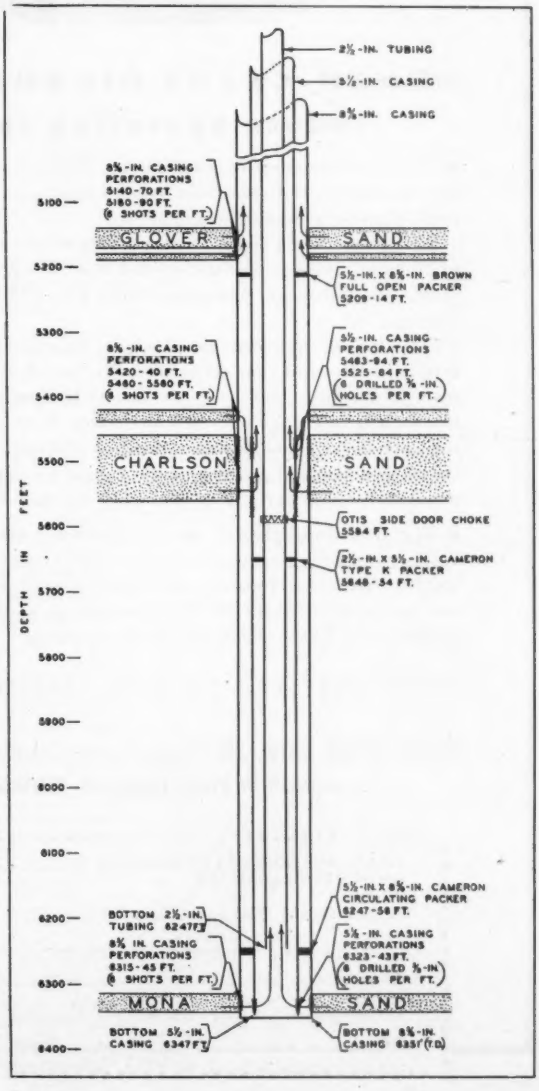

2½-IN. TUBING
5½-IN. CASING
8⅝-IN. CASING
8⅝-IN. CASING PERFORATIONS 5140-70 FT. 5180-90 FT. (6 SHOTS PER FT.)
GLOVER SAND
5½-IN. X 8⅝-IN. BROWN FULL OPEN PACKER 5209-14 FT.
8⅝-IN. CASING PERFORATIONS 5420-40 FT. 5480-5560 FT. (6 SHOTS PER FT.)
5½-IN. CASING PERFORATIONS 5483-94 FT. 5525-64 FT. (6 DRILLED ⅜-IN HOLES PER FT.
CHARLSON SAND
OTIS SIDE DOOR CHOKE 5584 FT.
2½-IN. X 5½-IN. CAMERON TYPE K PACKER 5640-54 FT.
DEPTH IN FEET
5100
5200
5300
5400
5500
5600
5700
5800
5900
6000
6100
6200
6300
6400
5½-IN. X 8⅝-IN. CAMERON CIRCULATING PACKER 6247-58 FT.
BOTTOM 2½-IN. TUBING 6247 FT.
5½-IN. CASING PERFORATIONS 6323-43 FT. (6 DRILLED ⅜-IN HOLES PER FT.
8⅝ IN. CASING PERFORATIONS 6315-45 FT. (6 SHOTS PER FT.)
MONA SAND
BOTTOM 5½-IN. CASING 6347 FT.
BOTTOM 8⅝-IN. CASING 6351' (T.D.)

Fig. 3—Subsurface installation for triple completion of Oklahoma Natural Gas Co. 1-B Duke, Chickasha field, Grady County, Oklahoma

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● The Armstrong plant produces 5 million gallons of paint and varnish annually; operates a 250 kva GE turbine generator and a 500 hp Fairbanks-Morse 2 cycle Diesel generator at 250 volts in one engine room; three 400 hp Chicago-Pneumatic 4 cycle Diesel generators at 2300 volts in a second engine room.

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opened. After about 30 minutes, the Glover sand began cleaning itself under its own pressure, with the assistance of gas pressure from the lower two horizons.

After the Glover sand was clean, lowering of the 5½-in. casing was undertaken. Since the bottom blowout preventer had not leaked during the cleaning up process, the top preventer head was opened for the lowering operation. The string was lowered until the extra-heavy collar was resting on top the steel seat of the rams on the bottom blowout preventers. This seated both packers on the string, and thus isolated the Glover zone from lower two zones.

The next and final step was to finish cleaning up the Charlson and Mona zones, bring them in jointly, and then separate them. First it was necessary to kill these zones, which was done by circulating mud through the 2½-in. tubing. While this was being done, the Glover sand was allowed to produce through the 8⅝-in. casing into the mud pits. After circulating for several hours to be certain the two lower zones were dead, connections not needed were removed from the well head and the remainder of the permanent well head, consisting of tubing head on the 5½-in. head (Fig. 2) was installed. The well then was cleaned, using gas pressure from the Glover zone, introduced through a tubing-head connection, to force the mud from the two strings in much the same manner as was done when cleaning up to bring in the Glover zone. When both zones were cleaned, the tubing packer was seated and the side-door choke in the tubing closed, which separated two zones.

With all zones separated, deadweight pressure gages were taken on each zone for 10 days to make certain all packers were holding. After the 10 days, there was 1,527 psi. pressure on the Glover zone, 1,309 psi. pressure on the Charlson zone, and 1,950 psi. pressure on the Mona zone. with no apparent leakage. The Charlson (middle zone) was then opened to the atmosphere and the pressure of the other two zones was carefully checked for any drop. Pressure remained constant, proving no leakage existed.

The hookup of the completed well is shown in Fig. 1. The Mona sand, produced through the tubing (top outlet), carries a relatively high fluid content and is produced through a separator. Flow is passed through a heater ahead of the separator to prevent the formation of hydrates in the pressure drop through the separator. The Charlson sand, produced through the 5½-in. casing (middle outlet), and the Glover sand, produced through the 8⅝-in. casing (bottom outlet), are flowed direct to the individual meter settings (Fig. 2). A drip on each line ahead of the meter settings removes any condensation.

Cat-Cracking Feed Stock Improved by Delayed Coking

by R. B. Tuttle

This article describes the modern delayed coking process. Operating, yield, and other information contained therein is derived from data published by M. W. Kellogg Co.

A PROBABLE solution to one of the problems likely confronting the refiner concerned with currently marketable cat-cracked products, appears to be contained in a recent report on the delayed coking process. Available information on this process indicates that cat-cracking efficiencies may be greatly increased by the improvement of feed-stock quality. Yields with the exception of residuals, are shown to run considerably higher than those realized from the usual methods employed in most refineries that operate feed-preparation units. Pilot-plant tests on a typical East Texas crude indicate that delayed coking makes approximately 3 per cent more of the crude available for catalytic-cracking than is made available by visbreaking. Further comparison with the same method reveals that when processing a 30 per cent reduced crude the delayed coking process yields more than twice as much cracked gasoline, one-sixth more gas oil, and no tar. Visbreaking of the same stock gives a (F.O.E.) gas yield of about one-half of that produced by delayed coking. On a weight basis coke yields are shown to average about 12.5 per cent for East Texas reduced crude stocks and slightly less for Mid-Continent. The yield data reported on delayed coking of various reduced crudes represent an average of several pilot-plant runs and for comparison purposes is expressed in round figures.

Hydraulic Removal of Coke

Coke removal, which was a major problem with the earlier units, is now performed hydraulically. Inexpensive and without the usual hazards encountered in previous methods for cleaning coking drums the lately improved method is highly successful in its over-all operation. Ordinary mechanical cutting tools are not employed in the operations, consequently tools which require special facings and careful heat treatment for their cutting edges are eliminated. Actual cutting and boring are accomplished by hydraulic jets and nozzles at the end of drill stems which are operated from above the coke bed. An over-all advantage of the hydraulic method is that the coke is free from contamination and is sized ready for market.

Devised by Shell Oil Co., Inc., this hydraulic decoking method was developed by Worthington Pump & Machinery Corp. and is incorporated into several delayed coking units built by M. W. Kellogg Co.

Operated on a continuous throughput basis the modern delayed coking operation differs from usual thermal cracking in that the quickly heated topped crude passes from the pipe still at high temperatures into an insulated drum where it is coked by its contained heat. The coke drums operate at pressures from 5 to 50 psi. depending upon the kind of feed stock and upon the desired yields. High flexibility is an important feature of the process as for example where market conditions are such that production of a given viscosity fuel oil is desirable the unit may be operated to reduce topped crude without producing coke. Other interesting variations which give an indication of the method's flexibility is that of production of gas oil from a typical Mid-Continent 30 per cent reduced crude which may be varied from 700° to 900° F. in end point and by 25 per cent of normal yield. Coke yields may likewise be varied over a broad range. Crude which has been topped through its light virgin gas oil cut yields about 12 per cent of its weight in coke, 4 per cent gas, and the balance to liquid products which includes a 750° F. end-point gas oil.

The bubble tower produces overhead gas and gasoline and gas oil bottoms. The gas oil boiling range may be lowered if desired by recycling and its end point may be varied by altering the coking temperature and pressure.

By alternately charging, coking, and cleaning the several drums which comprise the coking section of the modern unit the results of a constant throughput process are obtained. Sequence operation of the drums is a relatively simple procedure wherein a drum which is filled with coke is cut out of the system for cooling and decoking and a cleaned drum is cut into service. Prior to returning a cleaned drum to service it is preheated by passing hot vapors, from the drum service, through it in increasing volumes until the proper temperature has been reached, then it is cut into service and the coke-filled drum taken out for subsequent cleaning.

Among the several advantages offered by the delayed coking process are cleaner cat-cracked feed stocks and the conversion of undesirable heavy products to lighter products and to marketable coke.

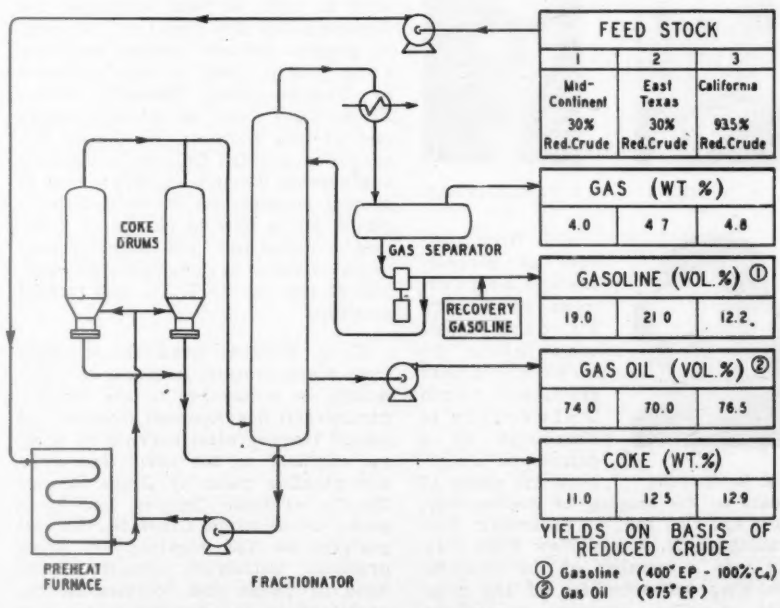

Fig. 1—Simplified flow arrangement and yield tabulation for delayed coking process

New Integral T.C.C. Unit Makes Catalytic Cracking Available to Small Refiners

by H. D. Noll, E. V. Bergstrom and K. G. Holdom

A SMALL-SCALE integral T.C.C. unit has been developed by engineers of Houdry Process Corp. and Socony-Vacuum Oil Co., Inc. The unit can be designed to process from 1,000 bbl. per stream day of virgin charging stocks ranging from heavy naphthas to vacuum distillates. Its simplicity of design and flexibility of operation make catalytic cracking feasible and practical for operators of smaller refineries. The unit is characterized by high yields of high-quality product at high liquid recoveries with low investment cost and low operating and maintenance costs. The integral design and simplicity of construction details make for a high percentage of onstream time.

One outstanding and generally recognized feature of the T.C.C. process is the high yield of useful products per unit of feed disappearance and per unit of catalyst deposit. Liquid recoveries (gasoline plus butanes plus cycle gas oil) range from 97 to well over 100 per cent depending upon the character of the charging stock and the conversion employed. These high liquid recoveries are obtained by operating at conditions where catalytic action can be maintained at a maximum and deleterious thermal side reactions kept to a minimum. These operating conditions require the maintenance of relatively high catalyst activity and, for very high conversions, recycling of catalytic gas oil.

As a result of careful control of regeneration conditions the catalyst activity in T.C.C. units is maintained at a high level. The Thermofor kiln regenerates in stages or zones each having its own air and coolant control. The portion of the catalyst deposit containing high concentrations of material other than pure carbon is removed in the initial stages at low-temperature conditions (875°-975° F.). Thus, water vapor and oxides of impurities such as sulfur are removed from the regeneration process before any high-temperature combustion occurs. It then becomes possible to reactivate the catalyst fully by burning off carbon to a very low residual concentration on catalyst without incurring losses in activity from high-temperature contact with steam or sulfur compounds. This stage burning allows high catalyst activity maintenance with relatively low catalyst replacement rates. Performance on commercial units throughout the war program has demonstrated the practicability of maintaining activities of 30-31 A.I. for clay with 0.5-0.6 lb. per bbl. makeup and 34-36 A.I. for synthetic catalyst with 0.15 to 0.27 lb. per bbl. makeup.

HIGH yields and high total liquid-gas recoveries mark the operation of modern T.C.C. units; liquid recoveries range from 97 to more than 100 per cent, depending on charge and conditions. Catalyst activity index (A.I.), of 30-31 may be maintained for clay catalyst, 34-36 A.I. for synthetic catalysts.

Recycle operations are desirable especially in smaller units; yields (motor gasoline) may be boosted from 42 per cent for no recycle to 65 per cent with 1:1 recycle ratio. Details are included here of the design of several important points in the equipment for operating the T.C.C. process.

This article was presented at the annual meeting of the Western Petroleum Refiners' Association, Fort Worth, March 25-27.

TABLE 1

Catalyst activity index—	28	32
Conversion	60.0	60.0
Temperature	860	860
Gasoline, vol. %	46.0	48.4
Liquid recovery, vol. %	99.2	100.9
Coke, wt. %	4.0	3.6
Dry gas, wt. %	7.6	6.8

Curves of equilibrium activity index vs. catalyst makeup rate are shown in Figs. 1 and 2.

Table 1 has been prepared from correlations to illustrate the effect of catalyst activity on gasoline yield, liquid recovery, and coke production at constant gas-oil disappearance.

It will be noted that with the lower catalyst activity the coke plus dry

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H. D. Noll, manager of process-analysis department of Houdry Process Corp., was born in Brooklyn, and graduated from University of Pittsburgh as a petroleum engineer. He spent 19 years in the employ of Socony-Vacuum Oil Co., Inc., at Beaumont, Tex. Paulsboro, N. J., and New York City. He was a member of the catalytic cracking subcommittee of the aviation gasoline advisory committee, PIWC.

E. V. Bergstrom was graduated from University of Illinois, B.S. in mechanical engineering, in 1930. From 1930 to 1938 he was employed by Standard Oil Co. (Ind.) at Whiting, as general refinery design engineer. From 1938 to 1943 he was employed at Pan-American Refinery Corp., Texas City, Tex., as refinery-design and project engineer. He joined Socony-Vacuum Oil Co., Inc.'s, refinery engineering division in 1943 acting as project engineer on its bead catalyst plant. He is now in charge of a design engineering and development group engaged in developing mechanical design for the T.C.C. and related processes.

K. G. Holdom, graduate engineer from Massachusetts Institute of Technology, is a member of the Houdry commercial development division. He joined Houdry after serving as process engineer on the 100-octane aviation-gasoline plant of Cities Service Oil Co. at Lake Charles, La., for 2 years. Prior to his Cities Service experience he had acquired 6½ years' practical petroleum experience as head of yields and correlations department in the process division of a construction engineering company.

gas yield has increased by 1.2 per cent while the gasoline yield and liquid recovery have decreased by 2.4 and 1.7 per cent respectively.

In many instances and especially in the case of installation in smaller refineries recycle Thermofor catalytic cracking is particularly attractive. Only moderate recycle ratios are required to produce gasoline yields far beyond the reach of thermal processing methods. The quality of such gasoline is as good as or better than that produced by single-pass operation and the increase in investment cost is minor in relation to the substantial gasoline yield increase. In many cases this type of operation can be readily fitted into existing thermal-cracking equipment at a considerable saving in investment cost. Table 2 shows yields for single-pass operation and for recycling at 0.5/1 and 1.0/1.0 (recycle/fresh feed) ratios on a typical Mid-Continent wide-cut gas oil using 30 A.I. clay catalyst.

TABLE 2

Recycle/fresh feed ratio—	0/1	0.5/1.0	1.0/1.0
Debutanized motor gasoline, vol. %	42.0	56.0	64.8
Total B-B, vol. %	10.0	12.8	15.3
Cycle gas oil, vol. %	46.0	28.0	15.0
Dry gas, wt. %	6.5	8.0	9.6

Mechanical Features

The main components of the catalytic section of a T.C.C. unit consist of the reactor where oil vapors are contacted with hot catalyst, the kiln where the resulting carbonaceous deposit is burned off and the catalyst regenerated, and bucket elevators to transfer catalyst from the bottom of the kiln to the top of the reactor and from the bottom of the reactor to the top of the kiln. Auxiliary equipment includes a compressor to supply inert gases for sealing the top of the reactor from atmosphere, an air blower and line burner for supplying combustion air to the kiln, and a steam-generating system in which water is pumped through the kiln cooling coils after which the steam generated is disengaged in a flash drum; an elutriator the purpose of which is to control the particle size of the catalyst being circulated; a fresh-catalyst makeup hopper and facilities for supplying fresh catalyst to the hopper, and a fines storage bin. This equipment is all of simple and rugged construction.

A characteristic feature of the catalyst flow in a T.C.C. unit is the low catalyst velocities required to circulate the relatively low tonnage of catalyst per hour. The vertical downward velocity of the catalyst in the kiln and reactor is of the order of 6 to 12 in. per minute. The velocities in the catalyst carrying lines are in the range of 1 to 2 ft. per second. No erosion has been encountered in plants of the latest design. In the kilns of early installations, some erosion of the refractory kiln lining was experienced. This was corrected by application of hard-face refractory coatings and on later installations by the use of suspended refractory brick walls. Inspection indicates that kiln linings of the latter type will have an indefinite life.

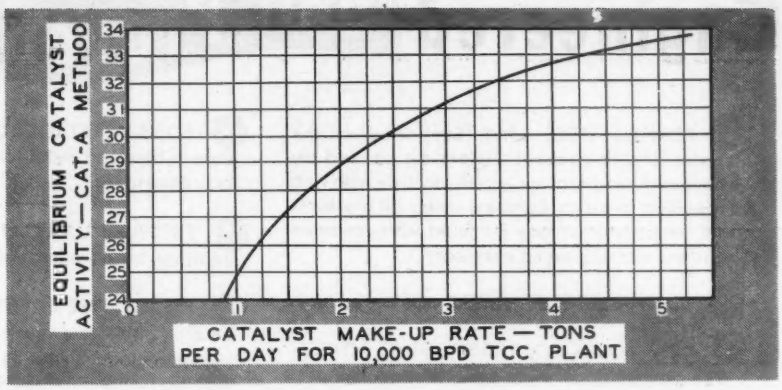

Fig. 1—Thermofor catalytic cracking. Equilibrium catalyst activity versus catalyst makeup rate, clay catalyst

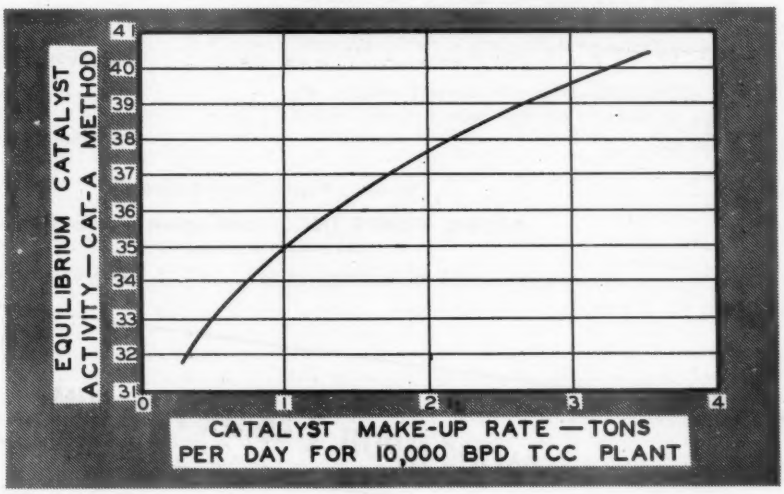

Fig. 2—Thermofor catalytic cracking. Equilibrium catalyst activity versus catalyst makeup rate, bead catalyst

No erosion whatever has been experienced in vertical catalyst pipes, but on sloping lines the bottom of the pipe as originally designed eroded out quite rapidly. This erosion was completely eliminated by installing small vertical baffles at intervals in the bottoms of the lines so that a layer of stagnant catalyst remained in the bottom of the pipe and the moving catalyst flowed over this stationary catalyst instead of over the bottom of the pipe. Largely because of the extremely low catalyst velocities employed, erosion in T.C.C. units proved to be a simple and easily corrected problem and may be considered at the present time to be completely eliminated.

Catalyst is supplied to the reactor through a vertical pipe approximately 50 ft. in height depending upon the pressure to be maintained within the reactor. This pipe called the seal leg has a hopper at the top end into which the elevator discharges. This hopper is maintained full of catalyst so that the seal leg also remains full of catalyst at all times. It is therefore possible to operate the reactor at a pressure as high as 15 psi. with the upper end of the seal leg open to atmosphere with catalyst flowing downward through the seal leg against the higher pressure below and without discharging oil vapor to atmosphere, by virtue of the effect of the deadweight of the column of descending catalyst together with the fact that sealing gas flows upward through the catalyst instead of oil vapor. This is done by injecting at the lower end of the seal leg a stream of inert gas a small part of which descends into the reactor and emerges with the product oil vapors, and the balance flowing up the seal leg at a rate sufficient to cause a pressure drop equivalent to the pressure differential between the top of the reactor and

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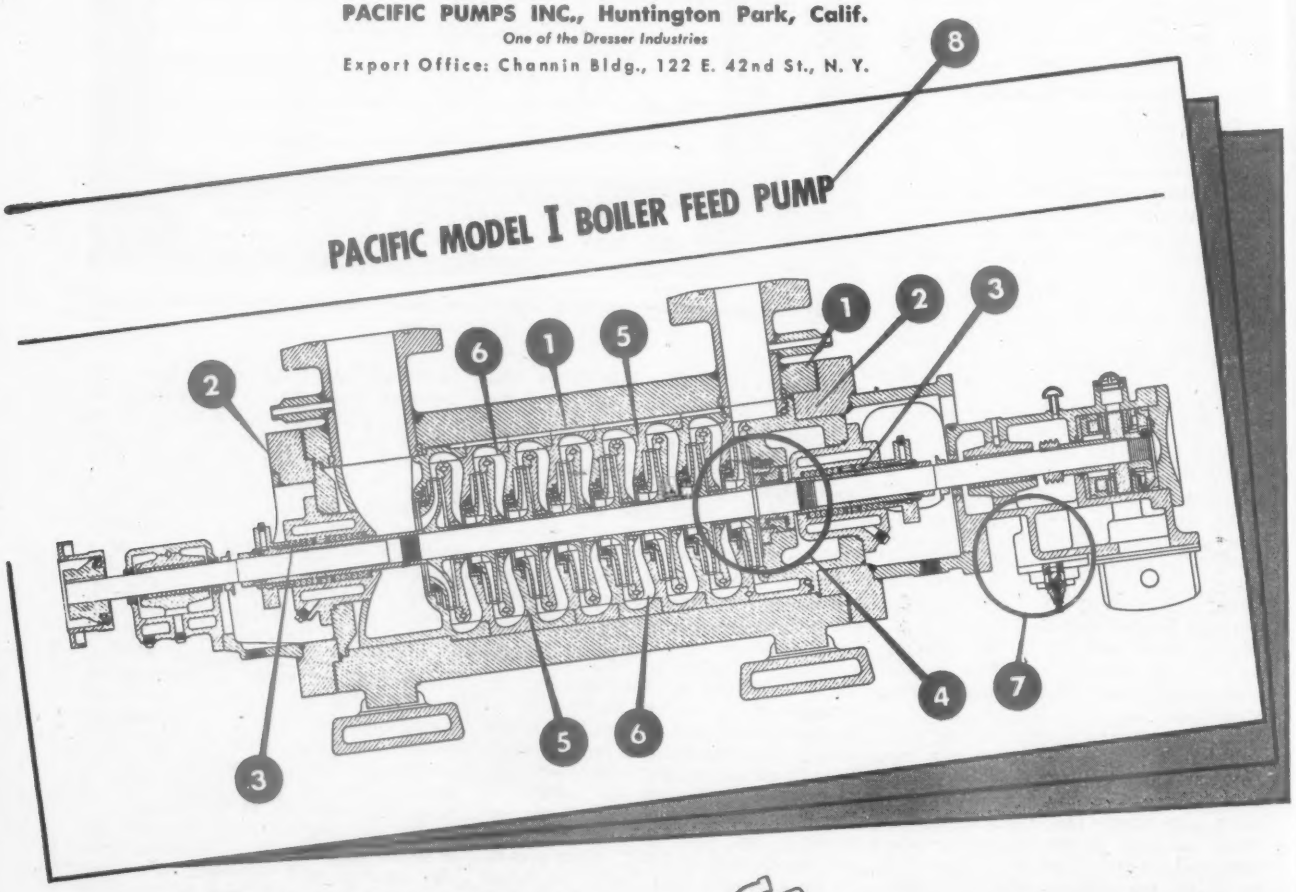

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atmosphere. The seal leg has proved an extremely simple and foolproof means for introducing catalyst from atmospheric pressure into the higher pressure of the reactor. There is no possibility of blowing a charge of catalyst from the reactor with this arrangement.

The kiln operates under a pressure not more than 1 psi. above atmospheric and usually less and is therefore an inherently safe piece of equipment. The bucket elevators are vented to atmosphere. These atmospheric vents provide a positive separation of the kiln and the reactor and reliance need not be placed on differential pressure valves or such devices to insure that hydrocarbon vapors from the reactor will not enter the combustion zone of the catalytic unit.

When the first T.C.C. unit was built there was some question as to whether bucket elevators would give continuous service at the high temperatures and loads to which they would be subjected in a T.C.C. operation. A 500-bbl.-per-day plant had been built and operated for a year using a common commercial-type bucket elevator and water cooling the head shafts. Only minor troubles were encountered with the malleable iron chain links in this equipment. The T.C.C. elevators now manufactured by Jeffry Elevator Co. have been designed for high-temperature operation utilizing the best materials and metallurgical knowledge available. Consequently, even the first units built anticipate a satisfactory chain life of 18 months to 2 years. In the early installations the top chain-sprocket teeth wore quite rapidly due to uneven application of hard surface material during manufacture. In spite of this it has been possible to obtain from a set of sprockets a life of 12 months or more by simply reversing the teeth. The most recent elevator improvement has been complete elimination of sprockets, substituting a traction drive between the chain and traction wheels. In this manner wear has been distributed around the periphery of the traction rim instead of being concentrated locally at the sprocket teeth and latest wear measurements indicate the anticipated life to be 5 to 10 years for a set of traction rims.

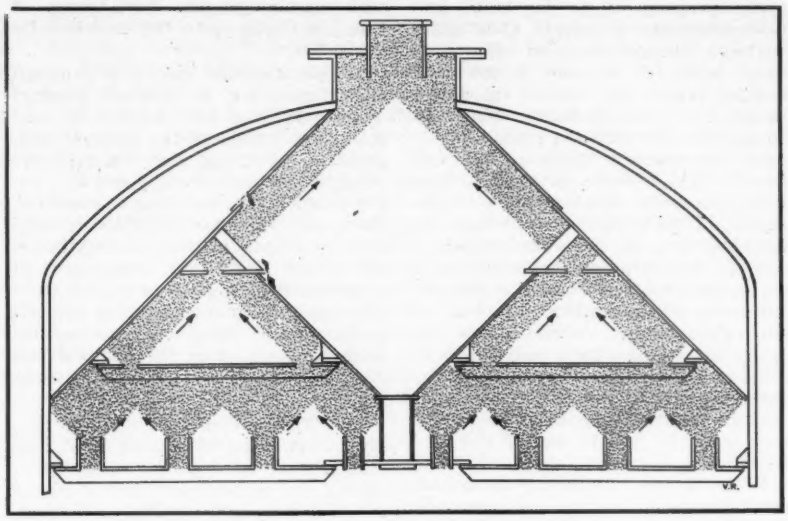


Fig. 4—Typical reactor drawoff baffles

Elevator circulating capacities used have been 100 tons per hour and 150 tons per hour with chain speeds in the range of 90 to 125 ft. per minute. At this circulating rate and speed, the power required to circulate catalyst is about 60-80 hp. No shutdown due to failure of elevator chains or sprockets has even been necessary on any of the T.C.C. units built to date.

An important feature of the flow of catalyst in the T.C.C. unit is the uniformity of flow on the cross-section in the kiln and the reactor. This is absolutely necessary if uniform reaction conditions are to be maintained in the reactor and uniform carbon combustion conditions are to be maintained in the kiln. This uniformity of flow in a catalyst bed of large area is accomplished by a system of draw-off baffles at the bottom of the reactor and the kiln. This catalyst flow-control system was developed by Socony-Vacuum research engineers with the aid of full-scale models and is one of the basic features of the T.C.C. technique (Fig. 4).

The catalyst flow rate through the kiln and the reactor is controlled by valves in the feed lines to the elevators. The latest type of valve provides close control of the catalyst flow rate and is of very simple rugged construction. In other locations for shutoff purposes, plug valves are used where

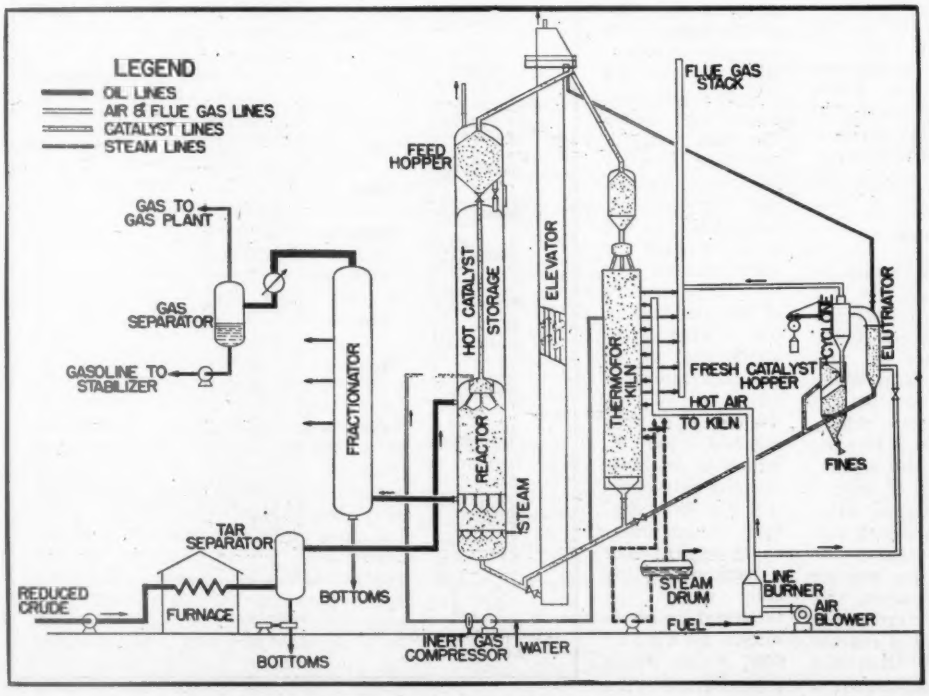


Fig. 3—Simplified flow diagram of typical T.C.C. installation, catalytic section

some pressure is to be held, and elsewhere just a simple slide plate between flanges is used. The catalyst level in the top of the feed hopper above the reactor is determined by a level indicator which on some units is connected with the catalyst flow-control valve in the feed line to the elevator in such a way that automatic level control is obtained. The importance of this interconnection is, however, questionable as feed-hopper-level stability is easily maintained with only minor adjustments at infrequent intervals at the catalyst flow valves. When the levels in the hoppers become low, makeup catalyst is added. Makeup catalyst enters the system from a catalyst makeup hopper which drains into the feed line to one of the elevators.

With its low circulating rates and catalyst velocities, and its relatively small forces and power required in circulation of catalyst, the T.C.C. unit utilizes a catalyst moving system which is inherently both safe and simple.

T.C.C. reactors up to the present time have been operated with hydrocarbon vapors flowing countercurrently to the descending flow of catalyst, but the flow in this respect may be either countercurrent or concurrent and the choice is a matter of operating conditions desired in any particular plant. In either system the catalyst bed remains a solid bed with the vapor flowing between the catalyst particles which remain in contact with each other and not in agitation in any manner. As a result hydrocarbon vapors are easily disengaged from the catalyst and only a small amount of dust (100-200 lb. per day) is carried into the fractionating tower where it is usually withdrawn with a simple settling pot from which dust and cold oil are discharged at infrequent intervals. Due to this extremely low catalyst carryover no circulation is necessary to return the catalyst to the system.

How Put on Stream

A T.C.C. unit is put on stream by circulating catalyst through the kiln and the reactor with the bucket elevators, the catalyst meanwhile being brought up to temperature by supplying preheated air to the kiln. When the proper temperature of catalyst has been reached the reactor charge stream which has been flowing through a bypass around the reactor is cut in slowly by means of motor-operated valves to the reactor, after which the bypass valve is closed and the unit is on stream. As soon as the hydrocarbon is fed to the reactor coke is deposited on the catalyst. The tar separator during the startup period is operated to produce a reactor charge of lighter gravity than the normal charge so as to lay down a reduced amount of carbon initially and enable gradual adjustment of kiln conditions until the unit is fully onstream.

In operating the reactor at constant throughput for a desired product three variables are subject to control. They consist of the catalyst temperature entering the reactor, the catalyst circulation rate, and the vapor temperature entering the reactor. Each one of these variables is subject to simple control and optimum conditions are easily obtained and maintained thereafter. A fourth variable on some units has been the adjustment of space velocity accomplished by changing the catalyst bed depth by means of adjustable feed pipes.

In a T.C.C. kiln with the low catalyst circulating rate used, if all the carbon were burned by merely introducing the theoretical quantity of air at the bottom and blowing it through the catalyst bed in one pass, the heat liberated would cause a temperature rise of the order of 800° to 1,200° F. in the catalyst. Consequently, the kiln is divided into zones from 5 to 12 in number depending upon the amount of carbon to be burned as determined for design purposes by pilot-plant runs on the refiners charge stock. A kiln zone consists of a bed of catalyst having residence time of the order of 5 to 10 minutes into which combustion air is introduced at the middle, the air flowing both upward and downward to outlet flue-gas collectors above and below the inlet distributors. The quantity of air supplied and the temperature of the air are controlled for each zone so that the temperature of the catalyst in the zone rises about 150° F. to a maximum of 1,100° F. When the catalyst has reached 1,100° F., which is well below the safe operating temperature, it continues in its descent over a bank of cooling coils where the temperature is reduced to about 950° F. at which temperature the catalyst enters the next zone below, where the same procedure is repeated. In the upper zones of the kiln the amount of carbon burned off in each zone is of the same magnitude, but as the carbon burn off progresses a longer time is required to burn off the remaining carbon. Consequently, the residence time in the lower zones increases and the residual carbon is burned off more slowly until at the bottom or cleanup zone the residence time is of the order of 20 minutes. In the upper zones the outlet flue gas is high in CO_2 and H_2O, most of the oxygen having been consumed. The flue gas from the bottom zone is high in oxygen since at this stage carbon concentration has been reduced so that a high oxygen concentration is necessary to achieve the very low final residual carbon on catalyst obtained in the T.C.C. kiln. The lowest bank of cooling coils is used for a final adjustment of kiln outlet temperature; i.e., reactor inlet temperature.

Kiln variables which are subject to control are the inlet air rate, the inlet air temperature, and the number of cooling coils in service. Any one of these three variables can be changed

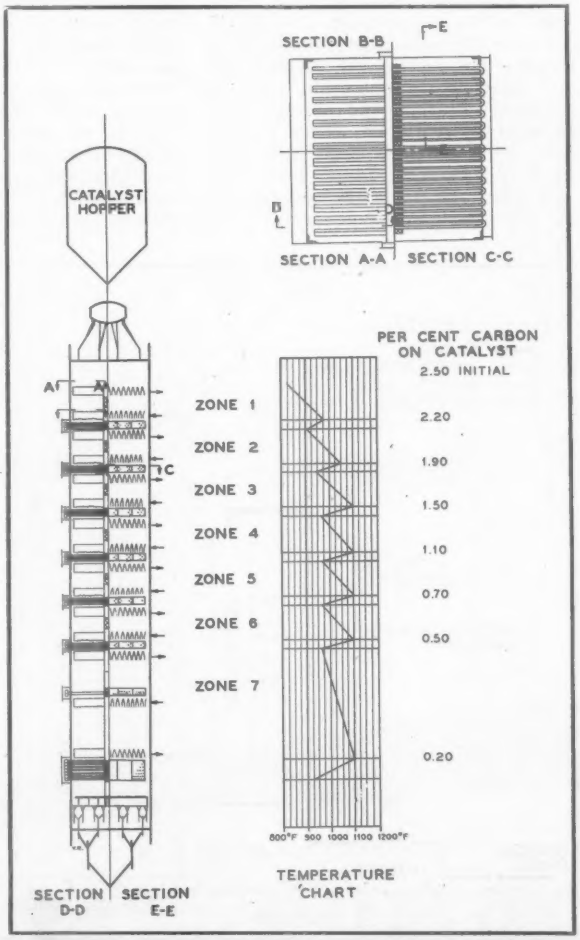


Fig. 5—Arrangement and operating conditions, T.C.C. kiln

to maintain close control of the kiln. Best operation to date has been accomplished by leaving all cooling coils in service, and by merely manipulating air temperatures and air rates to the various zones stable kiln conditions with excellent carbon burnoff are accomplished. Fig. 5 shows a typical vertical cross-section and temperature pattern through a kiln. The pattern of temperature rise in a kiln and the effect on temperature as a catalyst is passed over the cooling coils may be observed. Attention is directed to the low maximum temperatures in the initial zones where hydrogen and sulfur oxide concentrations are at a maximum.

The inlet air temperature to the kiln is controlled by the addition of heat in an air-line burner. Line burners may be fired with gas or oil and operate at the pressure of the air inlet duct system which is in the range of 1 to 2 psi.

Regenerating Air Supply

The blower supplying combustion air operates at a discharge pressure of 1½ to 2 psi. and handles cold air only. At this low discharge pressure and with air quantities in the range of 10,000 to 25,000 cu. ft. per minute the horsepower requirement for this blower is in the range of 100 to 300 hp. The combined horsepower required for supplying regenerating air and circulating catalyst consequently is a relatively low figure.

Materials of kiln construction are selected for the conditions existing or anticipated in the kiln. Low-chrome-alloy construction is used for the air distributors and collectors. The kiln walls are internally insulated and refactory lined. Cooling tubes are 1¼ chrome alloy. The remainder of material in a T.C.C. unit is carbon steel except as altered by specific corrosive conditions. The reactor-kiln section of the T.C.C. unit may be modified to permit handling of corrosive stocks for a minor increase in installation cost. It may be noted that equipment in a T.C.C. unit is generally of standard type readily obtainable, and maintenance work can be easily handled by labor normally used in any refinery.

The steam-generating system in the T.C.C. unit operates on the principle of forced circulation of feed water to the kiln cooling coils. The circulating pump has a capacity of 300 to 500 g.p.m. which is many times the feedwater rate actually required for the steam generated. Consequently, the mixture of steam and water from the kiln is returned to the drum from which the pump takes suction, where the steam is flashed, passes through a demistifier and thence to the plant steam system. The steam drum is located near ground level where all controls are readily accessible. Scale deposit in the kiln tubes has been negligible due to the fact that the tubes operate flooded with water. Although it would be possible to use all welded coil construction. it is considered desirable to use a removable plug type of header on one end of the tube coils so that they can be inspected or cleaned if necessary.

The designing of a T.C.C. unit for capacities in the range of 1,000 to 5,000 bbl. per day posed the problem of retaining all the inherent simplicity and safety features of the larger T.C.C. units and at the same time provide a low cost unit. Actually it has developed that the features of simplicity and low cost are closely related so that in the small T.C.C. units now available, simplicity and safety have been retained and the cost reduced well below that of the scaled-down versions of the conventional early designs. These results were obtained by condensing the size of the equipment, combining equipment where possible and omitting features and equipment proved unnecessary by experience. For example, in the early design a separate hot-catalyst storage drum is installed to contain the catalyst when the unit is shutdown and the reactor and kiln are to be inspected. In the low-cost T.C.C. unit this storage space has been placed above the reactor and surrounding the seal leg which necessarily must be about 50 ft. high. The reactor, hot-catalyst storage drum, and reactor feed hopper are thus built and erected as one vessel at a marked saving in cost.

In small T.C.C. units the regenerated catalyst circulating rate can be reduced to 50 to 75 tons per hour. This permits the use of a single elevator instead of two elevators, the single elevator being of the same standard design as on the large units with the exception of the elevator bucket arrangement. The spent catalyst and the regenerated catalyst are handled in the same bucket by the device of providing separate compartments in the bucket for each. In this arrangement the colder spent catalyst is placed in compartments on each end of the buckets next to the chain and the hotter regenerated catalyst in the middle compartment. An elevator chain has been found to operate more than 100° F. below the adjacent catalyst, the chain temperature will be in the range of 750° to 800° F.

The only cyclone separator to be installed will be that provided at the discharge of the elutriator where on a 100-ton-per-hour unit about 1,500 lb. per day of fines and dust is removed during elutriation. Experience has shown that cyclone separators in the flue-gas outlet ducts from the kiln are unnecessary as little or no dust carryover has been encountered except in the few cases where leakage due to a mechanical detail existed. The elutriator used for the purpose of controlling catalyst size has been located relatively close to ground level and arranged in combination with the fines bin and cyclone separator where all of this equipment is more easily accessible.

A considerable saving in structural steel is accomplished on the new small T.C.C. unit design by utilizing the inherent strength of the kiln and re-

TABLE 3—SUMMARY OF ECONOMICS

Case No.—	Base case			"A"		"B"	
Revenue:	c/gal.	B/CD	$/day	B/CD	$/day	B/CD	$/day
10 lb. R.v.p. motor gasoline	6.250	2,814	7,387	3,467	9,101	3,499	9,185
Kerosene	4.250	600	1,071	600	1,071	600	1,071
Residual fuel	2.145	1,210	1,089	727	654	687	618
Dry gas (F.O.E.)	2.145	437	393	287	258	271	244
Excess butane	1.450	....	....	26	16	12	7
Total revenue			9,940		11,100		11,125
Operating costs:							
Crude	3.330	5,000	7,000	5,000	7,000	5,000	7,000
Crude distillation	....	5,000	300	5,000	300	5,000	300
Vacuum reduction	....	....	....	....	....	750	89
T.C.C. cracking	....	....	....	*2,412	670	†2,450	612
Thermal reforming	....	900	168	640	146	640	146
Thermal cracking	....	2,750	400	....	....	....	....
Debutanization	....	....	18	....	20	....	20
Catalytic poly.	....	92	115	166	153	170	157
Gasoline inhibitor	....	2,814	3	3,467	3	3,499	3
Taxes, interest, insurance (incremental)	....	....	21	....	134	....	154
T.C.C. royalty	....	....	....	2,412	121	2,450	123
Thermal royalty	....	2,750	83	....	....	....	....
Cat. poly. royalty	....	92	19	166	35	170	36
TEL to 79 C.F.R.-M. (M cc.'s)	....	355	638	233	419	220	396
Total operating costs	....	....	8,765	....	9,001	....	9,036
Earnings per day	....	....	1,175	....	2,099	....	2,089
Differential payout period, years	....	....	....	....	2.45	....	2.92
Investments (process equipment only):							
Revamp. thermal and install T.C.C. catalytic section	....	....	....	....	775,000	....	800,000
Catalytic polymerization	....	....	150,000	....	200,000	....	200,000
Vacuum distillation	....	....	....	....	....	....	125,000
Total	....	....	150,000	....	975,000	....	1,125,000

*Visbreaking and 1:1 recycle cracking. †1:1 recycle cracking.

TABLE 4—T.C.C. UNIT YIELDS

Feed, BPCD:	Case A	Case B
Virgin gas oil	2,000	2,000
Vacuum gas oil	....	450
Visbreaker gas oil	315	....
Visbreaker gasoline	97	....
Total fresh feed	2,412	2,450
Recycle gas oil	2,315	2,450
Total reactor throughput	4,727	4,900
Yields on fresh:		
Butane-free gasoline, vol %	65.0	64.8
Butenes, vol. %	5.6	5.8
Butanes, vol. %	9.4	9.5
Cycle gas oil, vol. %	16.3	15.1
Dry gas (F.O.E.), vol. %	10.2	10.4
Propylene, vol. %	5.2	5.5

TABLE 5—THERMAL TWO-COIL CRACKING YIELDS

Reduced crude charge, BPCD	2,750
Butane-free gasoline, vol. %	44.7
Butenes, vol. %	2.2
Butanes, vol. %	3.0
Tar (8° A.P.I.), vol. %	42.5
Dry gas (F.O.E.), vol. %	12.4
Propylene, vol. %	3.0

TABLE 6—THERMAL REFORMER YIELDS

Feed:	Base case	Case A	Case B
Virgin heavy naphtha, BPCD	900	640	640
Octane No. C.F.R.-M.	37.0	34.5	34.5
Yields:			
Butane-free gasoline, Vol. %	71.0	84.0	84.0
Butenes, vol. %	4.5	3.3	3.3
Butanes, vol. %	4.5	3.2	3.2
Tar, vol. %	4.5	2.5	2.5
Dry gas (F.O.E.), vol. %	15.7	7.9	7.9
Propylene, vol. %	4.0	3.0	3.0
Gasoline octane No. C.F.R.-M. (C_4-free)	67 5	57.0	57.0

TABLE 7—TOTAL MOTOR-GASOLINE OCTANE NUMBERS

Total gasoline (10 lb. R.v.p.):	Base case	Case A	Case B
C.F.R.-M. (clear)	66.7	69.9	70.3
+1 cc. TEL/gal.	74.5	76.8	77.1
+2 cc. TEL/gal.	77.0	80.0	80.3
+3 cc. TEL/gal.	79.0	82.0	82.2
cc. TEL to 79 C.F.R.-M.	3.00	1.60	1.50

actor as structures to support all platforms required and to furnish top guides for the bucket elevator which is located between them. In addition to these major changes which in no way affect the ruggedness, safety, and flexibility of the T.C.C. unit, a great many improvements in mechanical details have been made as a result of experience with the units now operating. The new small units will operate on natural clay or synthetic catalyst interchangeably. It may be said that in all respects the small-sized T.C.C. unit is equal to the large units and in many respects it will be a more closely integrated unit.

Economics

To illustrate the advantages to be gained by the installation of T.C.C. equipment an economic study has been prepared for what is considered a typical refinery situation. It has been assumed that a refinery processes 5,000 bbl. per calendar day of typical Mid-Continent-type crude in topping, two-coil thermal cracking and naphtha reforming equipment. The two cases illustrating T.C.C. processing are based on revamping of existing equipment and addition of a T.C.C. reactor-kiln section for processing the material presently going to two-coil thermal cracking.

The cases considered are briefly outlined as follows:

Base case.—Present operation, crude topping, two-coil reduced crude cracking, deep naphtha reforming and catalytic polymerization of C_3 and C_4 unsaturates.

Case "A."—Crude topping, moderate naphtha reforming, T.C.C. 1/1 recycle cracking of overhead from flashing reduced crude with integral visbreaker circuit for flash tower bottoms; catalytic polymerization of C_3 and C_4 unsaturates.

Case "B."—Crude topping, mild naphtha reforming, T.C.C. 1/1 recycle cracking of overhead from reduced crude flash and vacuum flash towers; catalytic polymerization of C_3 and C_4 unsaturates.

The cases presented are based on the assumption that 600 bbl. per calendar day (12 per cent) of kerosene would be marketed. The price structure and utility values used are listed below:

Feed and products:	Price
Mid-Continent crude, bbl.	$1.40
Housebrand gasoline (78 C.F.R.-M.), cents per gal.	6.00
Premium gasoline (83 C.F.R.-M.), cents per gal.	7.00
Kerosene, cents per gal.	4.25
Fuel oil (No. 6), bbl.	$0.90
Excess butanes (above 10 lb. R.v.p. gasoline), cents per gal.	1.45
Fuel gas, per MM B.t.u.	$15.00
Utilities:	
Steam (hp.), M lb.	$0.24
Power, cents per kwh.	0.70
Cooling water, cents per M gal.	0.50
Treated water, M gal.	$0.15
Clay catalyst, cents per lb.	4.00
Labor (avg. rate), man hours	$1.30

The gasoline price of 6.25 cents per gallon is based on 75 per cent housebrand (77.5 C.F.R.-M.) at 6.00 cents per gallon and 25 per cent premium (83 C.F.R.-M.) at 7.00 cents per gallon.

The above prices are, of necessity, arbitrarily chosen. For an individual refiner to obtain a true picture, his actual price structure should be substituted. The direct operating costs for the T.C.C. feed preparation and cracking section are appended in Table 8. Basic yields, capacities of the various refining units and clear and leaded octane numbers of blended gasolines are shown in Tables 4, 5, 6 and 7.

Table 1 gives a complete summary of over-all refinery economics for the

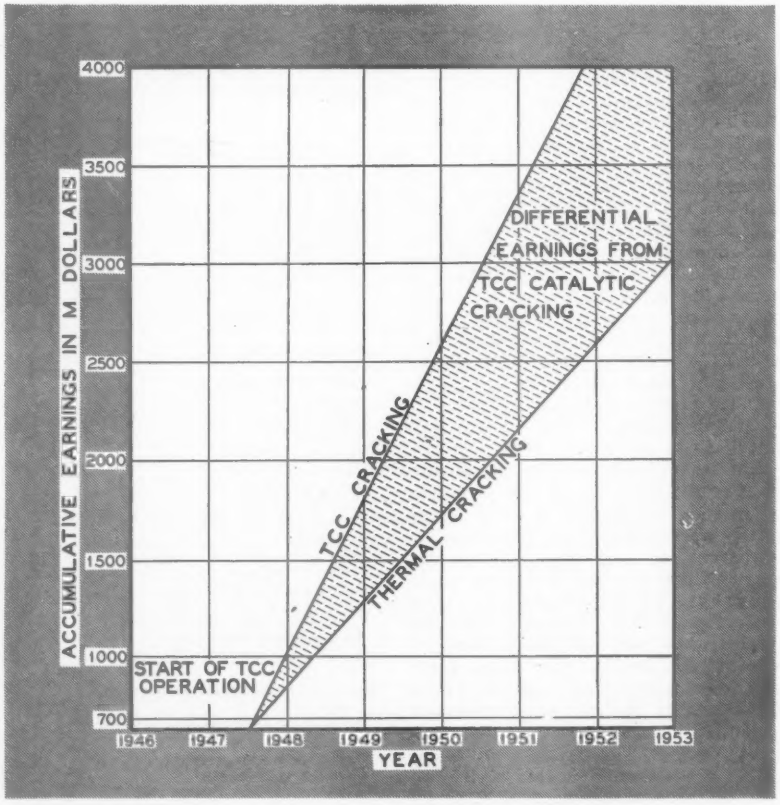
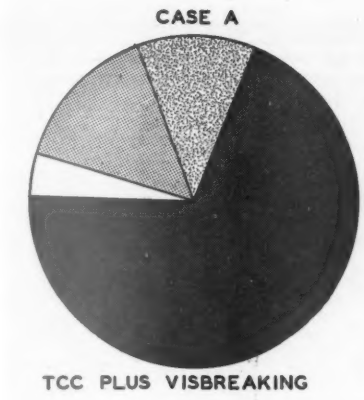
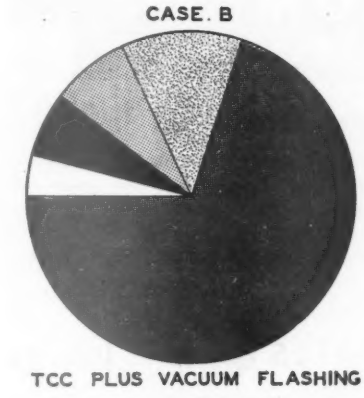
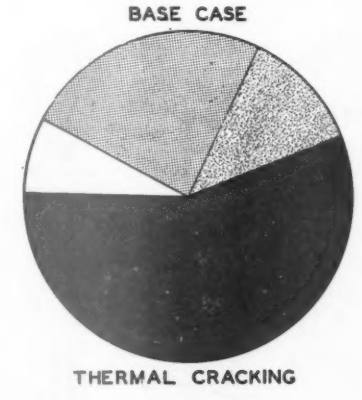
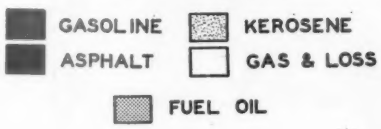


Fig. 6—T.C.C. economics of production versus thermal cracking

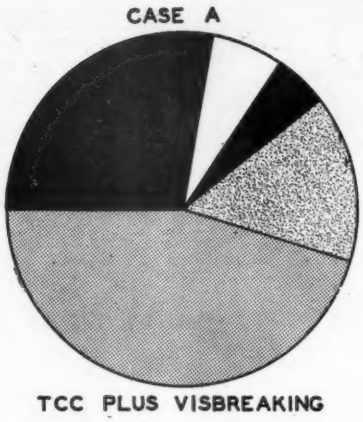


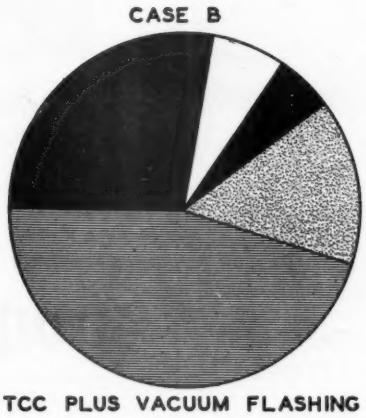


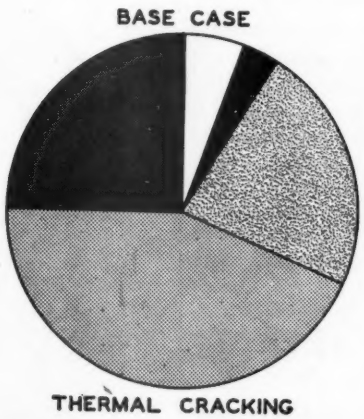




three cases considered. Case A shows a payout period of 2.5 years based on the new investment required. Earnings for this case over and above the base case are shown graphically in Fig. 6. Case B, on the basis of cutting back asphalt for fuel-oil production, shows a slightly lower return on a large investment. This case, however, gives greater flexibility in that fuel oil, or asphalt, or both may be produced as market requirements







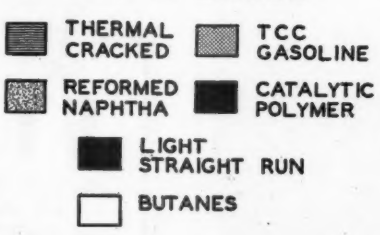


Fig. 7—(First column) Distribution of products

Fig. 8—(Above) Composition of gasolines

TABLE 8—DIRECT OPERATING COSTS T.C.C. FEED PREPARATION AND CRACKING

Case No.—	"A"	"B"
Fresh feed, BPCD	2,412	2,450
Total feed, BPCD	4,727	4,900
Item:	**$/day**	**$/day**
Operating labor (4 men/shift at $1.30)	125	125
Supervision and payroll burden	31	31
Works expense	70	70
Maintenance (labor and material)	123	110
Catalyst	120	120
Utilities:		
Hp. steam at $0.24/M lb.	18	*—6
Power at 0.7 c/kwh.	7	6
Cooling water at 0.5 c/M gal.	17	15
Boiler feed water at 0.15/M gal.	6	6
Fuel at $0.15/MM B.t.u.	153	135
Total direct oper. cost	†670	‡612
c/bbl. fresh feed	27.8	25.0
c/bbl. total feed	14.2	12.5

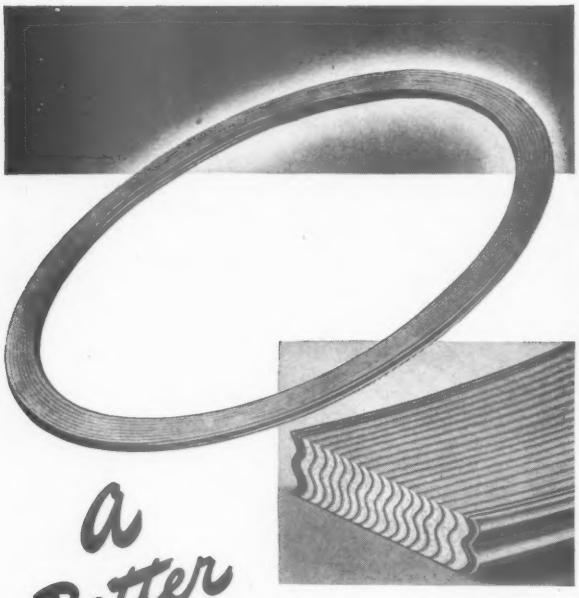
*Net production of horsepower steam. †Includes operating expense of visbreaker circuit. ‡Does not include vacuum tower

dictate. For those refiners who produce asphalt or lube oil this plan might be of considerable interest. Evaluation of asphalt product at any price higher than fuel oil value, of course, increase the earnings of this case.

A chart has been prepared (Fig. 7) based on the three cases presented, which shows the distribution of refinery products with and without the T.C.C. unit. It is immediately apparent that a considerable increase in gasoline yield is obtained by the installation of T.C.C. equipment. This increase is obtained from a decrease in fuel oil and fuel gas.

Fig. 8 shows the composition of over-all refinery gasoline for the three cases. The major effects of the catalytic installation shown are a slight increase in catalytic polymer, butanes, and light straightrun and a decrease in reformed naphtha. Cracked gasoline, thermal or catalytic, remains nearly constant, being slightly higher in Cases A and B than the base case. The lower reformed naphtha and the higher butanes in the gasoline are explained by the fact that with the installation of the T.C.C. equipment, it is not necessary to reform as severely as in the thermal case to reach the same octane level and lead requirement for the motor fuel. The reforming operation has therefore been reduced both in charge rate and severity. This results in a smaller quantity of lower octane number reformed naphtha and a greater requirement of butanes to make constant vapor pressure total gasoline.

The small T.C.C. unit will answer the postwar problem for operators of small refineries by producing higher yields of excellent quality gasoline at a reasonable manufacturing cost, and by providing ample allowance for further increases in quality should the competitive situation so demand.



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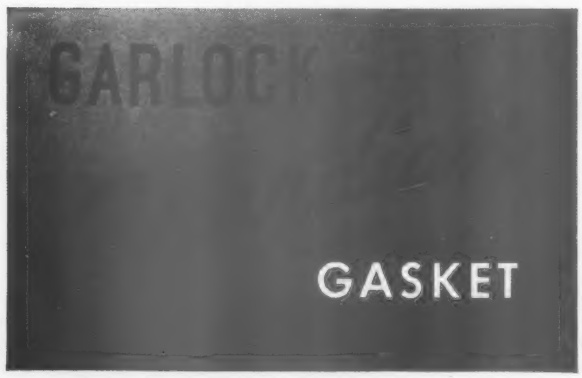

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QUESTIONS on TECHNOLOGY

by **W. L. Nelson**
Consulting Engineer

Simplified Flow Diagrams

Gasoline by Hydrogenation of Coal

What is the coal hydrogenation process that we hear so much about in Germany? Can you give temperatures and pressures?—W.N.S.

Coal hydrogenation is said to have been employed in Germany during the war almost to the exclusion of other processes of gasoline manufacture. In general the Germans preferred coal tar, whenever available, to coal because of the greater yields and operating economy.

The process is not new although undoubtedly detailed improvements have been made during the many years that the process has been practiced. It has been practiced even in this country in U. S. Bureau of Mines pilot plants (The Oil and Gas Journal, Hydrogenation of Coal, page 55, May 8, 1941). Shortly after 1921 the Bergius coal-hydrogenation process was practiced on a small scale in Germany producing liquid yields of 40 per cent from brown coals and 75 per cent from bituminous coals. In England the Imperial Chemical Industries completed a full-scale plant at Billingham in 1935 and this plant produced over a million barrels of gasoline during 1938.

The flow diagram on this page is the Billingham plant. The diagram shows two stages of hydrogenation—the primary or main hydrogenation of liquid (or paste) containing the coal, and a vapor-phase hydrogenation of so-called "middle oil." Some of the operations involved are:

1. Removing shale, rock, etc. from coal. (Flotation or other process.)

2. Manufacture of hydrogen by the water-gas reaction from hydrocarbon gases or other materials.

3. Powder coal and make into 50 per cent paste with heavy oil from the process or with creosote, etc.

4. Hydrogenation at 820°-860° F. at 2,000 to 7,500 psia. The latest German plants operated at nearly 10,000 psia. Vapor-phase hydrogenation may be conducted at 900° F. and it thus produces a more aromatic gasoline.

5. Hydrogen to the extent of 10-12 per cent by weight is required.

6. Iron sulfide is a common catalyst although volatile chlorides of the heavy metals and compounds of the alkaline earth metals have been suggested. A molybdenum catalyst is used for vapor-phase operations at Billingham.

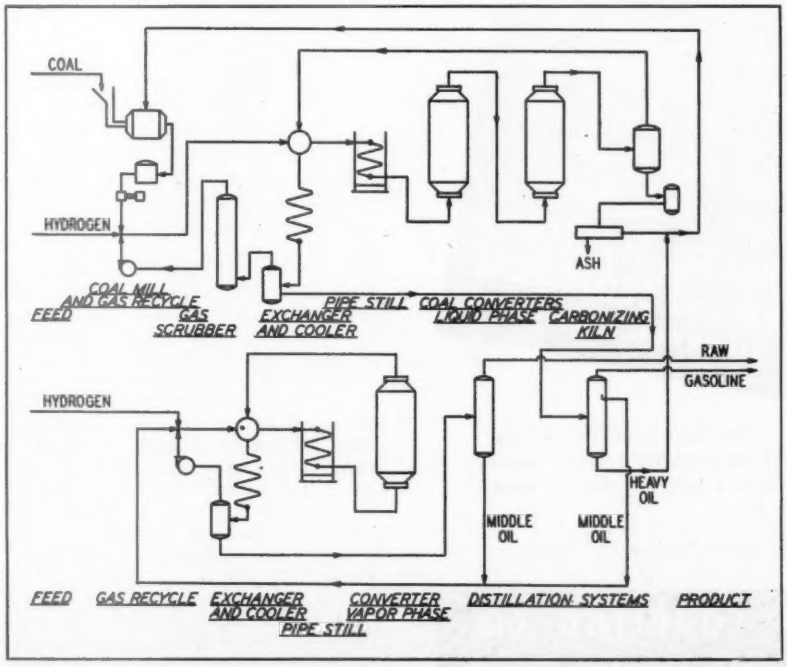
7. Time of contact is an economic proposition but enormous reaction chambers are required if the time exceeds about 1 hour.

8. Yields range from 48 to 90 per cent by weight depending on the amount of hydrogen and ash in the feedstock, and the liquid volume yield is even larger.

9. Products must be washed with alkalies for the removal of sulfide, ammonia, etc.

10. Plant cost varies widely—$10,000-$15,000 per daily barrel gasoline (complete plant).

11. Gasoline cost varies widely—11-23 cents per gallon.



Simplified flow diagram—hydrogenation of coal (two stage)

Flash Point of Gasoline

What is the flash point of gasoline? Some state specifications require a flash point below 110° F. and we think our gasoline always has a satisfactory flash point.—R.C.M.

Confusion should not arise over state specifications of flash point because flash point has no significance except for tax purposes. The states find that kerosene-like materials may be incorporated into gasoline in order to avoid the payment of motor-fuel taxes and hence specifications regarding flash point are necessary. However, flash-point specifications must be kept below the normal flash point of kerosenes and that is the reason for setting the value at 100°-120° F. Some states have specified (1945) that any materials that exhibit flash points below the following are classified as motor fuel:

	(°F.)
Louisiana	110
Kentucky	110
Wisconsin	110
Texas	112
Illinois	110

The flash point of regular gasoline is very low. It is usually well below 0° F. It can, however, be raised to above room temperature by exposure in thin films for a few minutes. The "Inflammability of Oil Films on the Surface of Water" is discussed on page 148 of The Oil and Gas Journal of May 12, 1938.

Flash of gasoline occurs at the temperature at which its vapor pressure is about 10 mm. (See "Flash Tests Useful for Judging Application of Light Oils," The Oil and Gas Journal, page 42, September 1, 1938). Accordingly the flash points of gasolines of various Reid vapor pressure are somewhat as follows:

Reid vapor pressure	Approx. flash point (°F.)
6	—35
8	—46
10	—50
12	—53

Selective Control

(Continued from Page 102)

different sizes. If a well produces 10 bbl. on a 1/64-in. choke it would theoretically produce 640 bbl. on the 8/64-in. or ⅛-in. choke. The percentage variation in production at each upward fractional step beginning at 1/64-in. would range from 300 per cent (between 1/64-in. and 2/64-in.) down to approximately 30 per cent from 7/64-in. to ⅛-in.

New Chokes Vary Well-Flow Rates in Increments of 10 Per Cent

The chokes recently placed in operation on a number of Gulf Coast properties have been designed in flow increments of 10 per cent. The experimental and field testing work to develop this type of bean was begun over a year ago in collaboration with a Gulf Coast operator. The 10 per cent increments of flow were arrived at by variations of choke design as to length, diameter, and other factors governing flow through orifices.

The selective control possible with the 10 per cent choke is brought out in detail in Fig. 1. The eight theoretical rates of production possible with fractional chokes from 1/64 in. to 8/64 in. are compared with the 31 different rates offered by the new chokes.

In addition to the flexibility of well-flow control possible with the new type of choke, another feature, to which operators attach considerable importance, is offered. The use of these chokes permits a pumper to make necessary changes in production rates without involved or difficult calculations. The chokes are numbered from 1 to 60, the latter number equivalent to a ½-in. choke. If a pumper has an X30 choke in a well, for example, which produces 100 bbl. a day, the next size larger (X31) should produce 10 per cent more or 110 bbl. The next size, X32, will produce 10 per cent more than the 110 bbl. produced by the X31, or 121 bbl.

In designing the new beans, field tests were necessarily made on free gas flow. In the case of a well flowing both oil and gas, it is necessary to insert one experimental, or trial, choke. This establishes the rate of flow of the new type of choke. Based on the flow rate of this trial choke any remote flow rate may be obtained by simply adding or subtracting in 10 per cent steps and noting the number of steps made. If an X32 trial bean produces 100 bbl. and 59 bbl. per day is desired, five 10 per cent steps down should be made which indicates the use of an X27-size choke.

In cases where the flow of free gas is involved, desired rates may be found on a chart, as shown in Fig. 2, and the correct choke selected without using a trial choke. The increase in flexibility of choke control is brought out in this chart which shows graphically the various rates possible with the new chokes compared with the fractional sizes. In using this chart the following correction factor should be used:

$$\frac{20.40\ C_d}{G\ T}$$

C_d = 0.865 discharge coefficient
G = 0.6 specific gravity, air 1
T = 520 absolute inlet temp., 60° F.

P. W. Beck has been advanced from assistant superintendent to acting superintendent of the Sheridan cycling plant in the Texas-Gulf organization of Shell Oil Co., Inc. **C. E. Carlson,** chemist at the plant, has been made acting assistant superintendent. Other recent personnel changes include: **A. C. Dahl,** senior exploitation engineer, transferred from Tulsa to Lake Charles; **F. Falcon,** exploitation engineer, transferred from Midland to Odessa; **A. R. Newman, Jr.,** junior exploitation engineer, transferred from Lake Charles to Houma, La.; and **L. Slagle, Jr.,** junior mechanical engineer, transferred from Midland to Odessa.

Tom J. Dwyer, engineer for Gulf Oil Corp., formerly stationed in Odessa, Tex., has been named assistant chief civil engineer and transferred to Fort Worth.

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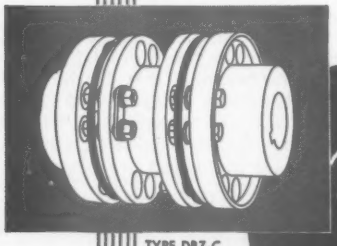

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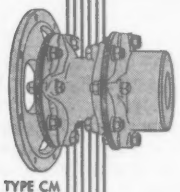

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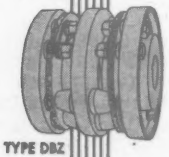

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The porosity of drill cuttings such as the above can be determined with accuracy comparing favorably to that of core samples. The cuttings in the small glass dishes have been washed and sized by screening and are ready for the tests

Porosity of Drill Cuttings Tested by New Method

by M. A. Westbrook and J. F. Redmond

POROSITY is a direct measure of the volume of the voids in a formation. It may be used for estimating the permeability of a formation provided that a correlation of these two properties has been obtained from the analysis of cores from the particular formation, and it forms a desirable aid in interpreting electric logs.[1]

These useful applications have emphasized the importance of developing a method for determining the porosity of the formations penetrated by a well by some means other than coring, for even in exploration wells it is neither economical nor practical to core all formations. Also, in wells where at the outset the coring program appears comprehensive, it is frequently found that, after certain layers are drilled, more complete information is required for evaluation. Porosity values, if obtainable, would be of great assistance in such cases.

In soft formations it is usually pos-

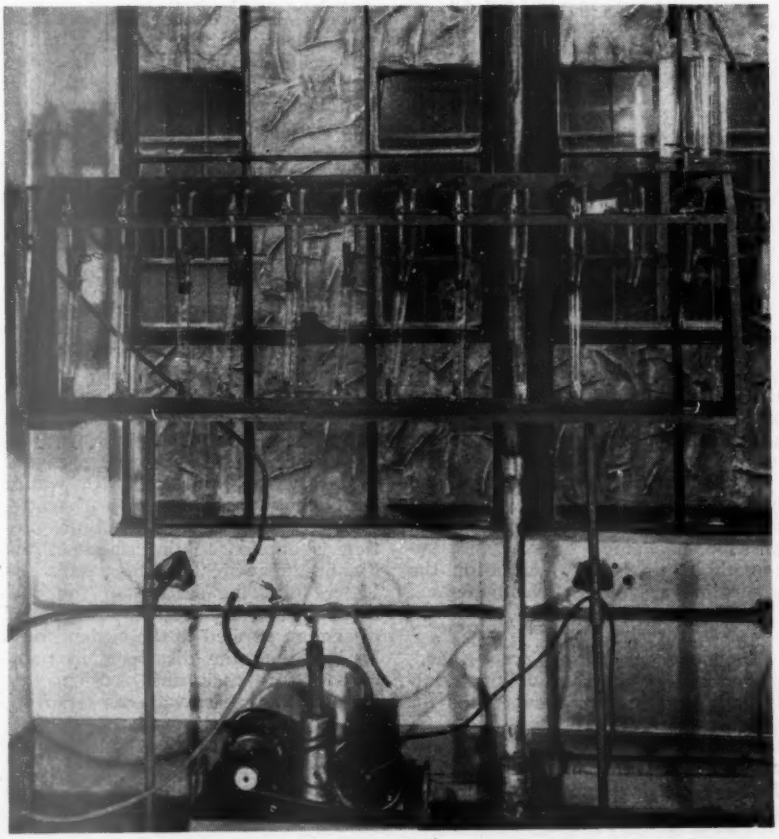

Fig. 1—Evacuation battery for saturation of drill-cutting samples under vacuum to determine the grain volume

THE AUTHORS

M. A. WESTBROOK J. F. REDMOND

M. A. Westbrook has been with Shell Oil Co., Inc., during the past 10 years and is supervisor of the production laboratory at Houston. He is a chemistry graduate from University of Houston.

J. F. Redmond studied chemical engineering at University of Kansas 1930-34 and production and refining engineering at University of Tulsa during 1939-41. He was chief chemist for Kansas Light & Power Co. for 2 years and has followed with 11 years with Shell Oil Co., Inc., as chief chemist of the production laboratory, Tulsa, in production research work at Emeryville, Calif., and in exploitation engineering and production research in the Mid-Continent and Texas Gulf Coast areas. He is now engineer in Shell's West Texas district.

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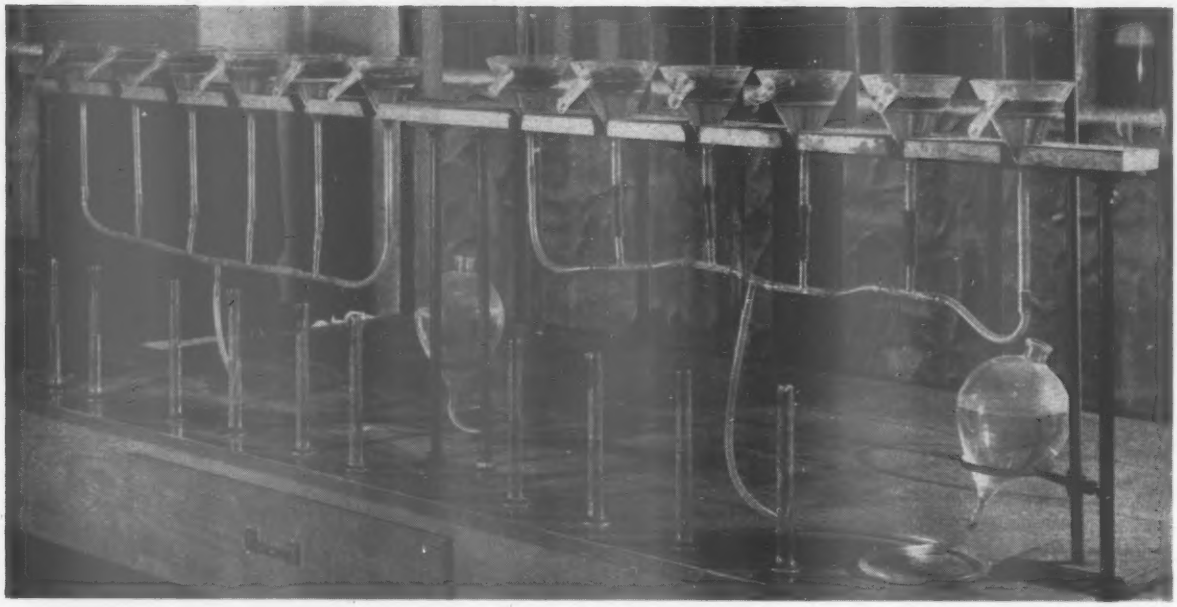

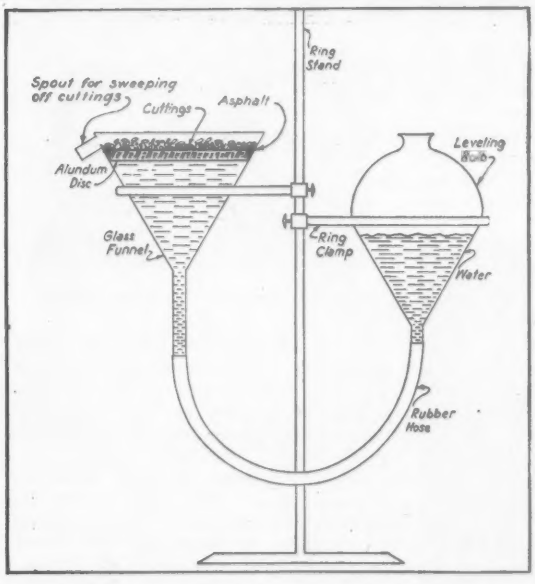

Fig. 2—(Above) Capillary diaphragm battery for removal of excess water and determination of bulk volume. The drawing at left is a diagram of the apparatus

sible to obtain porosities after drilling with cores taken by side-wall coring devices. In hard consolidated formations, that coring procedure is not always practicable and other methods for determining porosities must be resorted to. A first choice is the examination of drill cuttings, if an analytical procedure is available that is both accurate and reasonably rapid. Such a procedure has been devised and is applicable to sand and limestone cuttings having pores of capillary size. Although improvements can yet be made, it is believed that the new technique is sufficiently well developed to warrant description.

The well samples containing the cuttings representative of the particular intervals are first washed through a No. 6 gage screen. The cuttings remaining on the screen are large enough to use for the porosity measurements. From the sized sample, the cuttings to be examined are separated from the shale and other extraneous particles. It is recommended that 10 to 15 cc. of the selected cuttings be used for measurements, although only 4 to 5 cc. were used to make the comparative tests described later in this article. These cuttings are extracted and dried by the same methods used for preparing core samples for porosity and other measurements.

The separation, which is at present being carried out by hand, is the most tedious part of the procedure, and possible mechanical or otherwise automatic methods for facilitating the separation are being investigated.

Determination of Grain Volume

The clean, dry cuttings are weighed, placed in a weighed and volumetrically calibrated graduate, evacuated for approximately 20 minutes, and then saturated by allowing water to flow into the evacuated system (see Fig. 1). The system is next opened to the atmosphere and allowed to stand for 5 to 10 minutes, so that the water will completely penetrate the pores. Longer times may be required for cuttings having very low permeabilities. Water is added until the graduate is filled to the calibration mark. The graduate and contents are reweighed so that the weight of water added may be determined. This weight is converted to volume by knowing the density of the water at the temperature existing at the time the flask was filled to the calibration mark. The resultant volume subtracted from the flask's calibrated volume equals the volume occupied by the dry grains. This volume is later referred to as grain volume.

Determination of Bulk Volume

After the grain-volume measurements, the saturated cuttings are spread on an alundum (R.A. —98) disk, which is saturated and in contact with a column of water. A typical single-unit arrangement of this capillary diaphragm is shown in Fig. 2. As many diaphragms may be connected to a common water column as is desired, and any porous material may be used provided it is permeable and has a displacement pressure to air, when saturated with water, equivalent to at least 2 ft. of water.

By lowering the leveling bulb, suction is applied to the water in the diaphragm, which, in turn, pulls the water from the surface of the cuttings by capillary suction. The amount of suction applied to the system must be less than the displacement pressure of the rock analyzed. In this manner the excess water is removed, leaving each cutting completely saturated, with each pore filled to its surface opening.

From 15 to 20 minutes usually is required for the diaphragm to re-

move the excess water from the cuttings. The removal will be facilitated by turning the cuttings occasionally with a glass rod or spatula. Although it is not possible to tell by sight when the excess water has been exactly removed, its complete removal is indicated by the absence of a glistening caused by light reflected from excess water. Complete removal is assured by allowing the cuttings to remain on the diaphragm several minutes after the glisten has disappeared.

A suction of 1 ft. of water is in most cases considered safe, although it is possible that this suction would exceed the displacement pressure of some types of samples. Should the displacement pressure be exceeded, air would enter the pores and the cuttings would be partly desaturated. If it is desired to determine the maximum suction that may be used with a particular group of samples, check bulk-volume measurements may be made with gradually increasing suctions. When the bulk volume no longer remains constant, but begins to decrease, the limiting suction has been reached.

The capillary diaphragm automatically compensates for water evaporating from the surfaces of permeable cuttings while in place on the diaphragm. For example, when the excess water has been removed from the surfaces of the cuttings, evaporation of water will tend to dry out the cuttings. For desaturation to take place, however, air must enter the pores, which in turn means that the displacement pressure of the rock must first be exceeded. It will be remembered that the column of water in contact with the diaphragm and cuttings is adjusted so that the suction head is less than the displacement pressure. It is, therefore, more difficult for air to enter the cutting than for water to flow in from the diaphragm. Complete saturation of the cutting is thus maintained. This process will be effective unless the cuttings have very low permeabilities. For such cuttings the rate of evaporation from the surfaces may be more rapid than the rate of flow of water through the cutting to replenish the evaporation loss, and these impermeable samples should be covered while on the diaphragm.

The saturated cuttings are next transferred to a calibrated graduate containing sufficient water to cover the sample. The addition of 1 gram of ammonium nitrate per liter of water will prevent the adherence of air bubbles to the particles and eliminate foaming at the surface. The bulk volume is equal to the displaced water. The porosity value is then calculated from the formula:

Per cent porosity

$$= \frac{\text{Bulk volume} - \text{grain volume}}{\text{Bulk volume}} \times 100$$

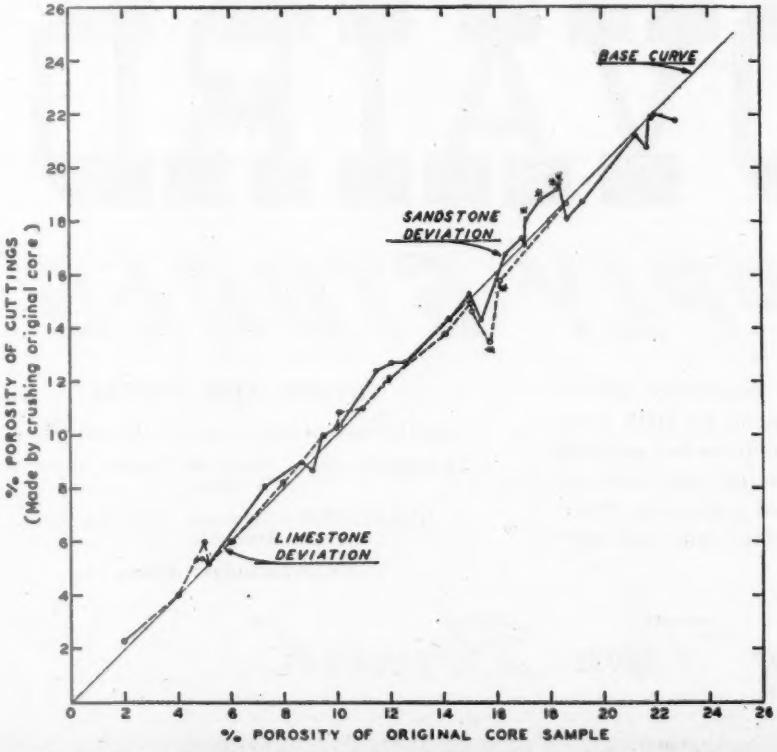

Fig. 3—Comparative porosity measurements between samples of cores and cuttings
**Anhydrite present in limestone sample and shale present in sandstone sample*

Comparison of Results Obtained

The accuracy of this procedure is demonstrated by the results of a number of comparative measurements plotted in Fig. 3. The results were obtained by first determining the porosity (by a standard core-analysis method) of sandstone and limestone core samples having bulk volumes of 4 to 5 cc. These pieces were crushed to a particle size comparable with that of the cuttings that would normally be obtained from a well. The porosity of the particle retained on a No. 6 screen was determined by the method described here. The average deviation of the two porosity measurements made on each sample was 3.3 per cent of the porosity.

Correct Depth Should Be Known for the Cuttings

Although the actual porosity measurement is satisfactory, it is obvious that the results are reliable only if it is certain that the cuttings analyzed are representative of the interval drilled. It is also desirable that the recovered cuttings be as large as possible, and that there be a minimum contamination by cuttings or cavings of shale and other shallower formations. For these reasons, special precautions often must be taken when drilling and sampling. In zones of particular interest, it may be necessary to drill intervals of, say, 2 ft. and to circulate the cuttings from the well before the next interval is drilled. Larger cuttings are recovered by using carefully conditioned drilling muds and increased mud-circulating rates. Reverse-circulating drilling methods have also been used to advantage for recovering representative and large cuttings.

References

1. G. E. Archie, The Electrical-resistivity Log as an Aid in Determining Some Reservoir Characteristics. Trans. A.I.M.E. (1942) 146, 54.
2. G. L. Hassler and E. Brunner, Measurement of Capillary Pressures in Small Core Samples. Trans. A.I.M.E. (1945) 160, 114.

Oscar Serrat, superintendent of operations for the northern zone of Standard Oil Co., S. A., Argentina, left Miami March 25 to return to Argentina following a business trip to company headquarters in New York.

Harold Barbour, vice president of Standard Oil Co., S. A., Argentina, left New York the week of March 25 to return to Buenos Aires following a business trip to the states.

Howard Waddle has been made manager of McKamie Gas Cleaning Co. at Magnolia, Ark., succeeding Robert A. Howe, who died several weeks ago. Waddle, formerly with Rex Drilling Co., Shreveport, and later an engineer for the Arkansas Oil and Gas Commission, has been operations engineer for McKamie Gas Cleaning.

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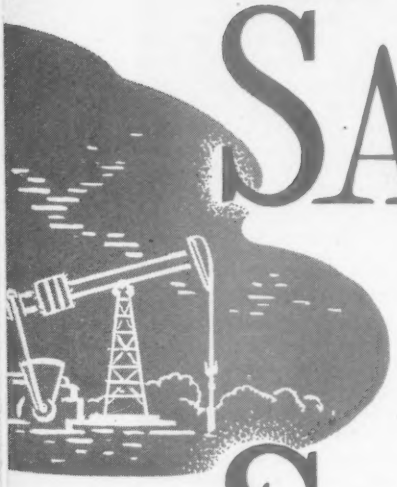

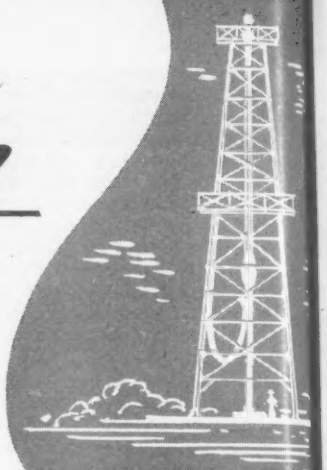

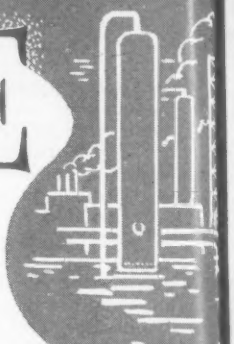

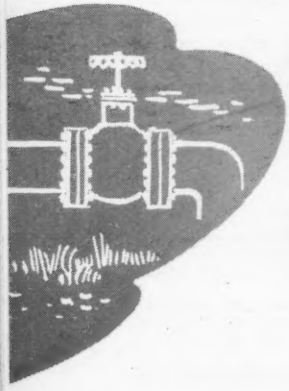

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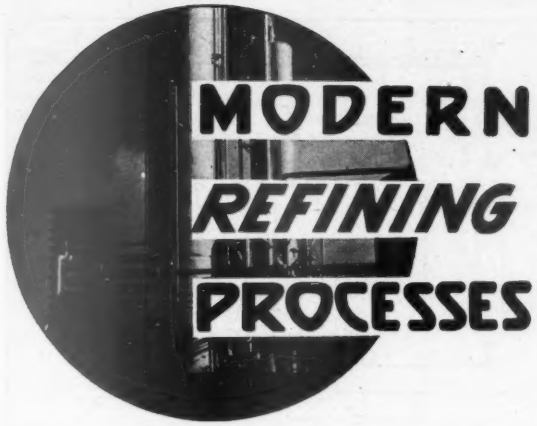


As much as nearly 5 per cent of the total crude charged to a thermal or catalytic cracking unit may be recovered as high-octane-number propylene and butene polymers by the use of one of three catalytic polymerization processes. These processes include the phosphoric acid process of Universal Oil Products Co., the copper pyrophosphate process of Polymerization Process Corp., and the silica-alumina process of Phillips Petroleum Co. Catalytic-cracking processes yield lower percentages of C_3 and lighter products in the gases from the cracking operation, therefore the total volumetric capacity of polymerization units operating on such tail gases need not be as large as those used for processing thermal cracking process gases. Nonselective polymerization is generally chosen because of its greater total yield, its lowest total investment and quickest economic payout.

5. Nonselective Catalytic Polymerization Has Important Postwar Utility

by George Armistead, Jr.

CATALYTIC polymerization of propylene and butylene has long been one of the basic refinery processes for increasing liquid recovery and improving the quality of total refinery gasoline production. The nonselective operations, for which the majority of the polymerization capacity was installed, have been employed for motor gasoline production while the selective processes have been directed to the manufacture of aviation gasoline components. During the war, most of the existing catalytic polymerization equipment was converted for the production of butene codimer and other selective polymers and some additional units were built for these purposes. The polymer products from these plants were used as feed for hydrogenation and alkylation operations and along with the cumene produced from the remainder of the plants comprised a valuable element of the aviation gasoline program.

In the return to peacetime operations with motor gasoline again in its dominant position, the production of nonselective polymer now occupies a more important place in refining operations than before the war. This is a result of the large amount of catalytic-cracking equipment built in recent years and under construction or projected since the end of the war, which equipment substantially increases the production of the C_3 and C_4 olefins per barrel of cracked gasoline produced. An example of the effect of the trend to catalytic process is shown in Table 1, which is a comparison of a characteristic all-thermal operation on Mid-Continent crude with two different types of catalytic operations on the same stock.

TABLE 1

	Self-contained processing of Mid-Continent crude		
Type operation—	All thermal*	Catalytic-thermal†	
Catalytic conditions:			
Temperature, °F.		850	900
Conversion, per cent		55	65
Yields, vol. per cent basis crude:			
Propylene	2.1	2.9	4.3
Propylene polymer at 65% recovery (10-lb. R.v.p.)	1.1	1.4	2.1
Butylene‡	3.1	3.4	4.0
Butylene polymer at 90% recovery (10-lb. R.v.p.)	2.5	2.8	3.2
Total 10-lb. polymer	3.6	4.2	5.3

*Reforming heavy straightrun naphtha, thermal cracking of 56 per cent reduced crude to ultimate yield of gasoline. †Reforming heavy straightrun naphtha, single pass catalytic cracking of virgin gas oil (40 per cent of crude), and thermal cracking of virgin residuum (16 per cent of crude) and catalytic cycle oil to ultimate yield of gasoline. ‡Total production.

The foregoing operations are for approximately equal gasoline yields from crude, in the neighborhood of 60 per cent. If the thermal-catalytic operation is run for ultimate gasoline yield, either by recycling to completion on the catalytic unit, the difference in polymerizable olefins is even greater than is shown. It is thus apparent that the increased use of catalytic cracking favors the enlargement of nonselective polymerization capacity. However, as was pointed out by Barnard and Forrester[1] in their 1944 study concerning the postwar light-ends situation, there are other dispositions of C_4 hydrocarbons competitive with catalytic polymerization, these including alkylation, sale as liquefied gas and sale for such uses as rubber synthetics manufacture. This is true to a lesser degree for propylene and it is seen from the foregoing tabulation that the relative amount of both butylene and propylene available for polymerization or other uses, is affected by the catalytic-cracking conditions to an important extent. The relative economics of catalytic polymerization as opposed to alkylation or sale of hydrocarbons is, of course, a matter depending upon conditions in the specific refinery.

The Processes

The two most widely used nonselective catalytic polymerization processes are those employing phosphoric acid and copper pyrophosphate catalysts and are designed and licensed

by Universal Oil Products Co. and Polymerization Process Corp., respectively. In addition, another similar process employing silica alumina catalyst is in use by Phillips Petroleum Co. The commercial application of the phosphoric acid catalyst process has been discussed extensively in the literature[2,3,4] and descriptive information has been published on the copper pyrophosphate process.[5,6,7] Both are so widely used and known that detailed description of their operation and character of their products is unnecessary. It is of interest, however, to note certain features of the operation pertaining to their present application.

Nonselective catalytic polymerization is normally employed on one of two general feed sources. For maximum polymerization of olefins from a cracking unit, the total gas from the unit is passed through the reactor in accordance with general arrangement shown in Fig. 5-1. This arrangement involves maximum investment, because of the necessity of handling a large amount of the relatively inert lighter hydrocarbons which must be picked up by compressors and for which capacity must be provided in reactors and subsequent fractionation equipment. The polymerization of total gas in this fashion reduces the amount of C_4 hydrocarbons available for straight blending but permits the inclusion of the maximum ultimate amount of these hydrocarbons in gasoline. This gives seasonal flexibility and may be useful in some situations where casinghead gasoline or extraneous butane may be profitable to blend for vapor pressure. Referring to Fig. 5-1, the overhead gas from the cracking separator is picked up by compressors and after joining with the C_3-C_4 cut from the cracking-unit debutanizer, passes through the treating unit for removal of hydrogen sulfide, following which it passes through a water wash and enters the other stage of the compressor which raises it to the polymerization reactor pressure, for example, 500 to 1,000 lb.

The high-pressure gas passes next through a heating coil and thence to the reactor. Products from the reactor pass through a cooler and thence into a high-pressure separator drum from which the overhead gases to an absorber operated in conjunction with the cracking unit which controls the ultimate recovery of butane. Polymer gasoline from the separator

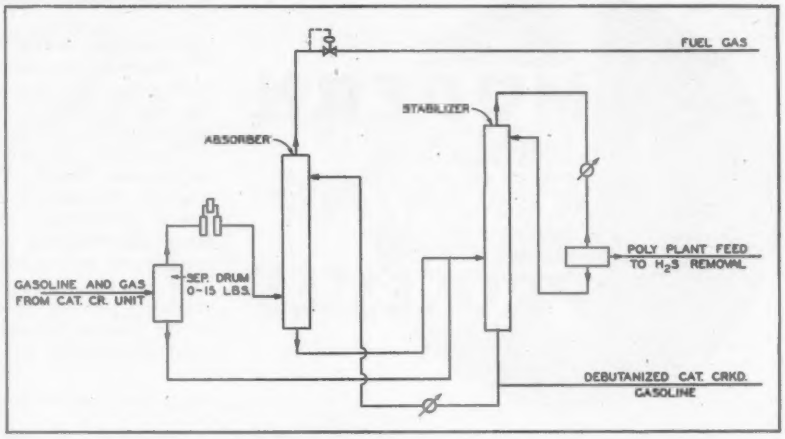


Fig. 5-3—Polymerization feed-preparation system for low-pressure source

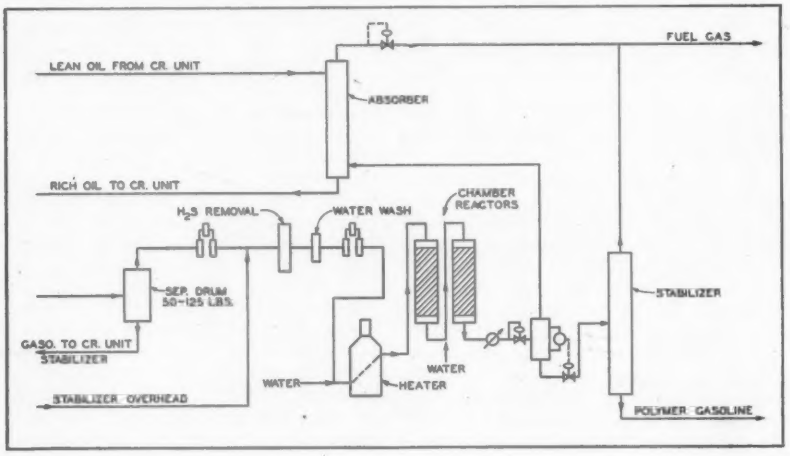


Fig. 5-1—(Above) Catalytic polymerization of total cracking-unit gas

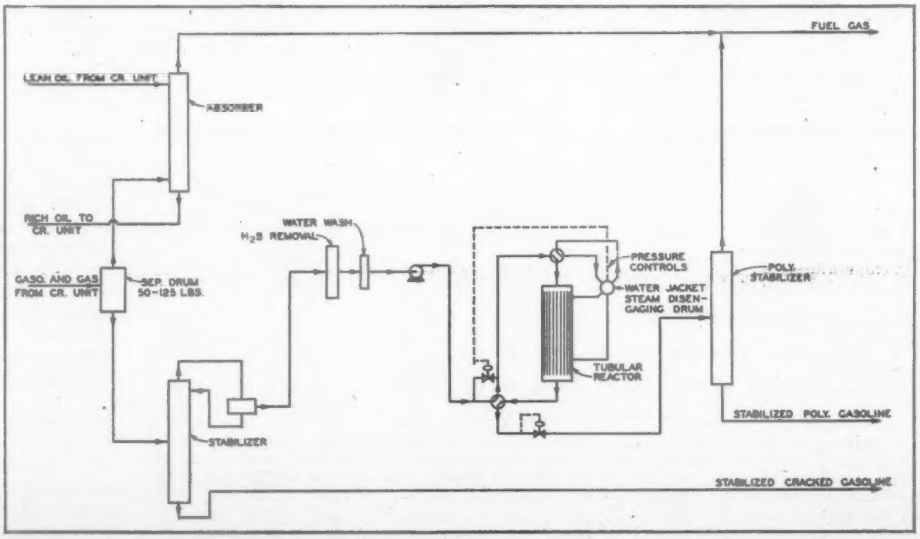


Fig. 5-2—(Right) Catalytic polymerization of stabilizer overhead

drum goes to the stabilizer for removal of propane and lighter. The polymer gasoline from the stabilizer contains all the butane recoverable from the cracking operations, and if desirable, may be passed direct to a debutanizer for reduction of vapor pressure before going to storage.

As has been pointed out by Shanley and Egloff,[3] operations on total cracked gas from ordinary thermal-cracking units according to the above-described method requires the handling of much more gas than if the polymerization reactor feed were taken from the stabilizer of the cracking unit. Fig. 5-2 illustrates this latter operation as applying to a thermal-cracking unit. Here, the cracking-unit separator drum cracked gasoline, usually available at 50-125 lb. and containing about two-thirds of the C_3 and C_4 olefins, is passed to the stabilizer which may be operated as a debutanizer and from which these hydrocarbons are taken overhead as polymerization feed, containing, for example, 35 to 50 per cent olefins. The C_3-C_4 stream passes thence to hydrogen-sulfide removal equipment, followed by water wash, and to a preheater prior to entering the reactor. The polymerized products pass from the reactor through coolers to the stabilizer as previously described.

In application to catalytic-cracking units this general system may be attractive although it will be justified on most of the units to compress all of the gas production for delivery to an absorber, due to the low separator drum pressure (0-15 lb.), a situation which does not prevail on the average thermal-cracking unit. A system for this purpose is illustrated in Fig. 5-3.

Smaller Investment Cost

This gas-recovery system involves somewhat less investment than would the handling of an equal quantity of thermally cracked gas due to the lower percentage of C_3 and lighter from the catalytic process which will run in the range of 30-40 volume per cent of the total C_4 and lighter compared to a range of 50-60 per cent in the case of the thermal-cracking process. Actually the recovery systems on existing catalytic-cracking units were generally built for the production of alkylation feed and are readily adaptable to supplying polymerization unit feed and a system such as in Fig. 5-3 would apply in the construction of new units directed at the production of motor gasoline and nonselective polymer.

The polymerization reaction is an exothermic one and to prevent excessive temperature rise with high

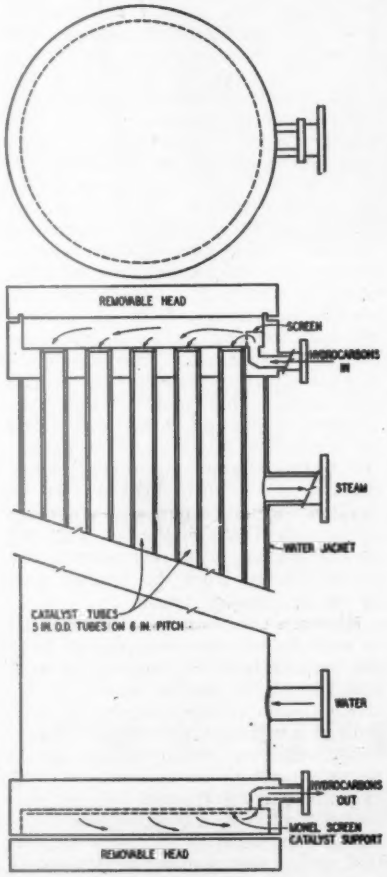
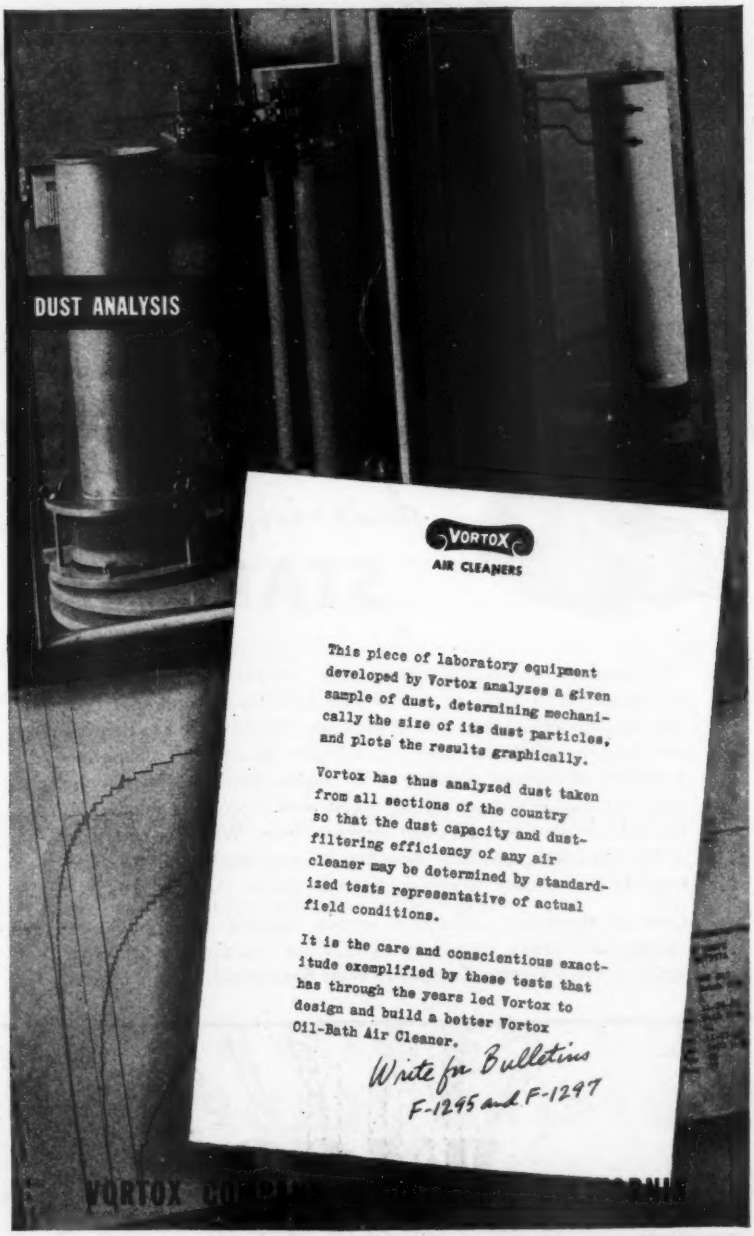


Fig. 5-4—Water-jacketed polymerization reactor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olefin feeds (e.g. 50 per cent olefins) it is necessary to recycle spent low-olefin gas to the preheater inlet to dilute the entering olefin feed down to a maximum olefin content of 30-35 per cent. This is particularly necessary in the case of a chamber or drum-type reactor with no other cooling, and on this type of plant recycle gas is sometimes admitted at a plurality of points in the reactor. A typical reactor arranged for effective control of the reaction temperature is the tubular unit equipped with water jacket for steam generation such as is shown in Fig. 5-4. It will be noted that the catalyst is carried in tubes surrounded by the water boiler which furnishes effective control. The tubes in the ordinary nonselective polymerization units are 4 to 5 in. i.d., although on certain selective units where temperature control is more important, 2-in. tubes have been used. Fig. 5-2 indicates one control mechanism for reactor temperatures by regulation of the cooling-jacket steam pressure.

Some of the earlier catalytic polymerization units of the phosphoric-acid type operate under conditions of 150-200 lb., whereas the newer plants with both catalysts operate at 500 lb. or above. In the low-pressure type, regeneration of the catalyst, i.e., burning off of coke deposits with air containing a controlled oxygen supply is required at intervals of about 10-15 gal. polymer per pound of catalyst, with about three such regenerations possible before catalyst discard is necessary. On the high-pressure units where fouling of the catalyst is retarded by the prevailing phase conditions, it is possible to obtain a life of 100 gal. per pound consistently in the average plant and much longer lives have in various instances been obtained.

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Catalyst Life

The various factors affecting catalyst life have been the subject of much study in commercial operations of the phosphoric acid and copper pyrophosphate catalyst processes. The most important of the facts that have developed from this experience are summarized in the following, and apply mainly to these two catalysts.

Oxygen in feed stock.—The presence of even minute quantities of oxygen (e.g. 0.002 mol per cent) in the feed tends to form a compound of a varnish-like nature from reaction of the oxygen and the olefins in the presence of the catalyst. In course of time this develops a stoppage in the catalyst bed near the entrance of the feed stream, which eventually will require a shutdown and replacement of the catalyst. Ordinarily oxygen is not a problem in feed to catalytic polymerization derived from thermal-cracking sources, although the presence of harmful quantities has sometimes resulted from such sources as air-containing wash water used following the hydrogen sulfide removal. In the handling of total gas from a catalytic operation through the polymerization reactor, however, it is suspected that the presence of oxygen or oxygenated compounds originating from air carried by the cracking catalyst from the carbon-burning zone may be sufficient to give the characteristic oxygen difficulties. This may exclude the practice of passing catalytic-cracking unit's gasoline separator drum gas direct to the polymerization reactor and require the olefin recovery to be made in an absorber and stabilizer system such as shown in Fig. 5-3 where oxygen or its compounds can be eliminated from the reactor feed in the fuel gas or liquid.

Nitrogen compounds.—It is essential to exclude nitrogen compounds from the polymerization catalysts, as very small amounts rapidly reduce its activity. Some of the sources of such poisons are the amino compounds carried over from the hydrogen-sulfide removal system as a result of misoperation, and ammonia used for corrosion control in some previous processing step, such as in crude distillation or on the cracking unit delivering the olefins to polymerization or natural ammonia compounds present in the crude. In general only the

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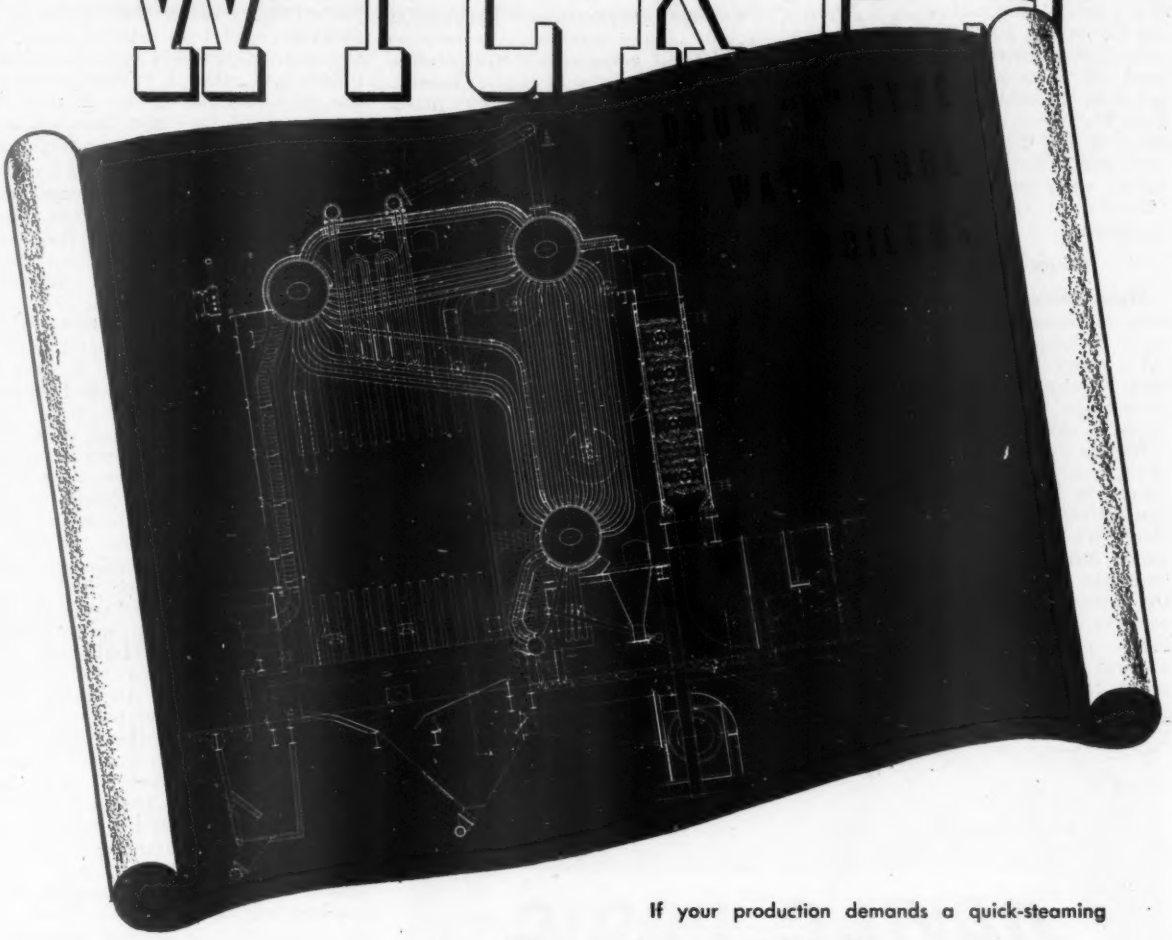

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nitrogen compounds removable with water appear to be harmful to the catalyst. It has been demonstrated that the cumulative effect of nitrogen compounds from such sources is such that a phosphoric acid catalyst acquiring 0.5 weight per cent (nitrogen expressed as ammonia) is seriously damaged and when the content reaches 1.0 per cent becomes useless. It is consequently considered desirable if not imperative that the polymerization plant feed stock be given a water wash before entry to the reactor, which is effective in removing the nitrogen compounds.

Water Added Directly

Water content of feed.—It is necessary for maintenance of catalyst activity to keep the phosphate catalysts in a properly hydrated form. This may require the direct admission of a controlled amount of water although in some cases the feed may contain sufficient water, and with the copper pyrophosphate catalyst the water acquired in the wash following hydrogen-sulfide removal is usually sufficient. When required water may be added directly to the reactor feed to maintain a partial pressure equal to the vapor pressure of the water in the catalyst. A content of water in the feed to the catalyst beyond the amount necessary to keep the phosphate in the proper form is of no benefit and tends to deteriorate the catalyst by reducing its strength. The rate of such deterioration depends upon the amount of excess water and can be rapid with large excesses.

Reactor temperatures. — Increasing reactor temperatures tend to increase the rate of polymerization of olefins and it is necessary to control reactor temperatures carefully as was noted in the foregoing. Fresh catalyst, being more active tends to give higher polymerization rates and therefore requires lower temperatures. In a nonselective polymerization operation the temperature is generally never allowed to exceed 500° F. and in most operations is held substantially lower to prevent excessive polymerization rates which would result in coking. Higher temperatures also tend to dehydrate the catalyst, as mentioned above, with a similar resultant effect. It is the practice where a number of reactors are employed in series, to charge catalyst in one reactor at a time, always having the reactor with the newest catalyst on the lowest olefin gas. This tends to insure against excessively high polymerization rates with the fresh catalyst. As mentioned in the foregoing, reactor temperature is controlled not only with the water-jacket arrangement on tubular units, but low-olefin recycle gas may be provided for reducing the olefin content and the consequent effect from the heat of polymerization. In addition to these precautions against too high reactor temperatures, it is necessary also to provide against too low temperatures. It has been noted that temperatures below 300° F. have a damaging effect on catalyst crushing strength, particularly with the phosphoric acid catalyst, evidently due to the accumulation on the catalyst of an excess of the ester intermediate of the polymerization reaction, at such temperatures.

In the removal of sulfur compounds from the polymerization plant feed, the standard equipment for this purpose in the larger plants is a regenerative system employing tripotassium phosphate or aliphatic amines. In the smaller plants or those with exceptionally low content of sulfur it is sometimes economic to use a simple caustic wash. The chief reason for removal of sulfur is that any contained in the feed issues with the polymer gasoline as mercaptans with the consequent effect on odor and lead susceptibility. It is general practice to design for a maximum of 5-10 grains hydrogen sulfide per 100 cu. ft., although considerably higher content is tolerable in operation.

Nonselective catalytic polymerization has long been a standardized operation with well-established performance and operating costs such as were discussed by Anderson and Sterba[8] in their recent paper. Either this process or one of the competitive ways of utilizing the C_3 and C_4 olefins must be employed in order to obtain maximum realization from refinery production. Of the several alternatives, nonselective catalytic polymerization generally requires the lowest investment and permits the quickest economic payout, which is the reason for its present extensive use, and its probable increased use with the construction of additional catalytic-cracking capacity. It is probable, moreover, that where existing nonselective polymerization capacity is not available to accommodate the output of war-built catalytic-cracking units, surplus equipment in shutdown alkylation plants or other aviation-gasoline equipment may be convertible in part for the purpose thus materially reducing the new investment requirements.

The high moisture adsorption of low-cost Driocel is maintained indefinitely. It can be restored by thermal regeneration time after time to produce bone-dry gases or liquids. This cuts drying costs. Driocel is being used by refiners and chemists to dry:

Feeds to alkylation and other catalytic processes.
Natural gas and pipeline gasoline.
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The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Standard Exchanger Tubing

O.D. of tubing	BWG gage	Thickness (in.)	Internal area (sq. in.)	Sq. ft. external surface per ft. length	Sq. ft. internal surface per ft. length	Weight per ft. length brass (lb.)	Weight per ft. length copper (lb.)	Weight per ft. length steel (lb.)	Metal area (transverse metal area)	I.D. tubing (in.)	Velocity, ft. per sec. for 1 gal. per minute
9/16	21	.032	.1952	.1473	.1304	.196	.206	.183	.053	.4985	1.65
⅝	10	.134	.100	.1636	.0937	.76	.800	.703	.207	.357	3.21
⅝	11	.12	.1170	.1636	.101	.70	.735	.647	.190	.385	2.74
⅝	12	.109	.130	.1636	.107	.649	.683	.605	.177	.407	2.47
⅝	13	.095	.149	.1636	.1142	.581	.61	.54	.158	.435	2.16
⅝	14	.083	.165	.1636	.1205	.520	.548	.481	.142	.458	1.95
⅝	15	.072	.1817	.1636	.126	.460	.482	.43	.125	.481	1.77
⅝	16	.065	.1924	.1636	.1295	.420	.44	.39	.114	.495	1.67
⅝	18	.049	.2181	.1636	.1379	.326	.342	.301	.0887	.527	1.47
⅝	20	.035	.2419	.1636	.146	.238	.25	.22	.0649	.555	1.33
¾	10	.134	.1822	.1963	.1265	.95	1.04	.882	.260	.482	1.76
¾	11	.120	.2043	.1963	.1335	.87	.918	.81	.238	.510	1.57
¾	12	.109	.223	.1963	.14	.807	.845	.75	.219	.532	1.44
¾	13	.095	.247	.1963	.147	.718	.752	.67	.195	.56	1.30
¾	14	.083	.268	.1963	.153	.640	.67	.591	.174	.584	1.20
¾	15	.072	.289	.1963	.159	.563	.592	.522	.153	.606	1.11
¾	16	.065	.302	.1963	.163	.514	.54	.48	.140	.620	1.065
¾	17	.058	.314	.1963	.166	.463	.494	.429	.128	.634	1.025
¾	18	.049	.334	.1963	.1707	.396	.417	.367	.108	.652	.962
¾	20	.035	.3632	.1963	.179	.289	.306	.267	.0786	.680	.885
⅞	8	.165	.2333	.2297	.143	1.348	1.42	1.251	.3681	.545	1.38
⅞	10	.134	.2890	.2297	.158	1.134	1.24	1.06	.312	.607	1.11
⅞	11	.12	.317	.2297	.167	1.04	1.096	.968	.284	.635	1.015
⅞	14	.083	.394	.2297	.186	.759	.798	.702	.207	.709	.817
⅞	16	.065	.436	.2297	.1952	.608	.636	.562	.165	.745	.737
⅞	18	.049	.474	.2297	.2034	.467	.49	.432	.127	.777	.681
⅞	20	.035	.508	.2297	.210	.340	.357	.314	.0927	.805	.634
1	8	.165	.355	.2618	.175	1.578	1.67	1.471	.4304	.670	.906
1	10	.134	.421	.2618	.192	1.34	1.41	1.24	.364	.732	.764
1	11	.12	.455	.2618	.200	1.22	1.28	1.13	.3317	.76	.707
1	12	.109	.479	.2618	.205	1.12	1.18	1.04	.306	.782	.672
1	13	.095	.515	.2618	.213	.99	1.042	.92	.270	.810	.624
1	14	.083	.5463	.2618	.2183	.88	.923	.813	.239	.834	.588
1	15	.072	.576	.2618	.225	.77	.813	.714	.209	.856	.558
1	16	.065	.594	.2618	.228	.70	.737	.65	.191	.870	.542
1 crimped	16	.065	.50	.2618	.228	.70	.737	.65	.191	...	.643
1	18	.049	.639	.2618	.236	.54	.568	.50	.146	.902	.505
1	20	.035	.679	.2618	.243	.391	.409	.361	.106	.930	.473
1¼	7	.18	.622	.3272	.232	2.213	2.36	2.057	.6052	.890	.515
1¼	8	.165	.662	.3272	.240	2.069	2.18	1.912	.565	.920	.485
1¼	10	.134	.757	.3272	.258	1.73	1.83	1.597	.470	.982	.425
1¼	11	.12	.801	.3272	.2644	1.56	1.633	1.45	.426	1.01	.402
1¼	12	.109	.838	.3272	.271	1.44	1.52	1.328	.389	1.032	.383
1¼	13	.095	.882	.3272	.279	1.27	1.33	1.172	.345	1.06	.364
1¼	14	.083	.923	.3272	.284	1.12	1.173	1.04	.304	1.084	.348
1¼	16	.065	.985	.3272	.293	.89	.934	.823	.242	1.12	.326
1¼	17	.058	1.012	.3272	.297	.80	.83	.738	.215	1.134	.317
1¼	18	.049	1.042	.3272	.301	.682	.714	.629	.185	1.152	.308
1¼	20	.035	1.092	.3272	.308	.498	.521	.454	.135	1.180	.294
1½	16	.065	1.474	.3927	.359	1.08	1.132	.996	.293	1.37	.218
1½	14	.083	1.397	.3927	.349	1.36	1.43	1.256	.368	1.334	.23
2	13	.095	2.573	.5236	.474	2.09	2.20	1.933	.569	1.81	.125

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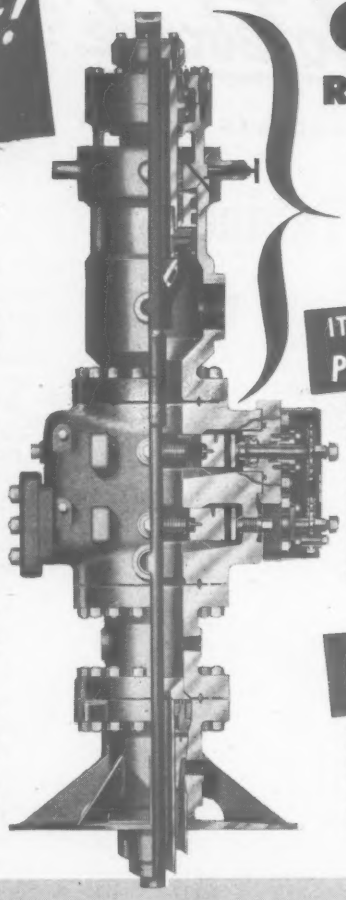

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THE IDEAL PRESSURE CONTROL COMBINATION *for all drilling work is the Shaffer Rotating Blowout Preventer and Stripper with the Shaffer Double Cellar Control Gate. Gives complete pressure protection whether drill string is in or out of hole!*

IT'S A PREVENTER

When drilling, this unit maintains constant protection against blowouts or pressure surges. As outlined below, it seals off around *any* unit in the drill string, whether square, hexagonal or octagonal kelly . . . or whether drill pipe, coupling, tool joint or drill collar. Moreover, it maintains this seal *constantly* and *automatically* and requires no manual or other adjustments to adapt it from one size or shape to another in the drill string.

When gas pressure is encountered, there's no need to shut down the well or even stop drilling. The stripper rubber keeps the well under complete control while the mud column is weighted to hold the pressure. Flow connections built directly into the unit *below the stripper rubber* permit this mud conditioning to be done quickly and easily . . . and the unit is so engineered that increased well pressure tends to seal the stripper rubber more securely against the drill string, thus assuring a tighter leak-proof seal.

IT'S A STRIPPER

As the drill string is raised or lowered in the well, the stripper rubber *automatically* expands or contracts to maintain a tight continuous seal. It not only maintains its pressure-tight seal around the drill pipe, couplings, tool joints and the drill collar . . . but it also automatically adapts itself to the shape of the kelly so that a perfect seal is maintained around this portion of the drill string, too. In fact, except for such abnormally large diameters as the bit and reamers—it will maintain a perfect seal around *any* and *all* elements in ordinarily-used drill string assemblies. Thus, the drill string can be stripped in or out of the well without losing pressure protection at any time!

★**IT IS SIMPLE!** No special operations are required for running pipe or making connections when drilling with this Shaffer unit. When it is desired to add pipe while drilling you simply raise the drill pipe through the Stripper, add the additional pipe, reconnect the kelly and lower the drill string back in the hole for continued drilling the same as in ordinary drilling work!

★**IT ROTATES!** In the Shaffer unit—unlike most blowout prevention equipment—there is no wear on the rubber when packed off against the kelly while drilling. The unit is so designed that the stripper rubber rotates *with* the kelly and there is no rotational movement between it and the kelly. This unique advantage not only minimizes wear but also assures maximum pressure protection by providing a constant and uniform seal around the entire circumference of the kelly at all times—a feature that is not possible where the packing element must be continually expanding and contracting as the kelly rotates through it. Another unique advantage is that there is no driving pressure between the packing element and the kelly. The unit is equipped with a floating drive (which is automatically withdrawn with the kelly) that locks the Preventer and the kelly into perfect rotational alignment. Thus, there is absolutely no rotational "slip" between kelly and stripper rubber!

★**IT RELEASES!** Here's another important feature . . . The internal mechanism is held in place by a Quick Releasing Bonnet which remains permanently on the body of the Preventer. When it is desired to lift the bit or reamer through the Preventer you simply pull a spring latch, turn the Bonnet ⅛ turn to the left and the complete rotating assembly can be readily withdrawn from the body on top of the bit or reamer. When going back in the hole, the operation is simply reversed. Thus, passing bits and reamers through the Preventer body takes only an instant!

★**IT'S COMPACT!** Like Shaffer Cellar Control Gates, the Combination Rotating Blowout Preventer and Stripper is engineered for maximum compactness so that it requires a minimum amount of vertical space in the drilling riser. Not only is the unit itself unusually compact, but flow connections provided *in the body* eliminate need for spools or additional equipment in the drilling riser to provide overflow connections. This saves still more space!

STEEL-REINFORCED STRIPPER RUBBER!

Note in this cutaway view how the rubber is backed by flexible steel latches. These form an expandable steel barrier that prevents extrusion when the rubber is subjected to unusually high pressures or mechanical forces. Because this steel barrier reinforces the stripper rubber at all times, large diameters can be pulled through it without difficulty or damage. Also, when abnormally high well pressures occur, although the stripper rubber is squeezed inwardly, it is protected both against damage and against losing its seal by this flexible steel barrier.

There are many other unique features engineered into the Shaffer Combination Rotating Blowout Preventer and Stripper. Get all of the details! See your nearest Shaffer representative . . . or write direct!

See pages 2687 to 2730 of your Composite Catalog for further information on Shaffer equipment.

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Engineering Fundamentals

No. 229

A FEATURE OF THE OIL AND GAS JOURNAL

Pinch-Out Trap Reservoirs

MANY of the world's largest oil deposits are found in reservoir beds that play out updip. The pinching out of a reservoir bed forms a trap, and the escape of oil and gas is prevented by impermeable strata above them. Accumulations of petroleum due to this type of trap are termed pinch-out trap reservoirs, and these are restricted to types located in stratigraphic intervals of zones which actually disappear.

Evidently the most important subsurface consideration in connection with pinch-out trap reservoirs is the establishing of the complete stratigraphic sequence for the area under consideration. This information is essential to determine at any locality whether a well has penetrated a normal section or whether downdip pinch-out trap possibilities are suggested by the absence of certain zones. There are few areas where such considerations are not called for.

In Types 1, 2, and 3, of Fig. 1, the margin of the pinch-out crosses the axis of the respective structure on which the reservoir is located. In the monoclinal types, 4, the margin has to form a salient pointing updip on the monocline, and in the synclinal type, 5, the reservoir bed must pinch out in all updip directions. Type 6 indicates a pinch-out trap reservoir in a strictly monoclinal position on the flank of an anticline, or on the side of a structural salient, where the margin of the pinch out does not cross the axis.

Pinch-out characteristics are connected with depositional conditions and with various features due to erosion, and the pinch-out trap reservoirs are divisible into depositional pinch-out reservoirs in stratigraphic wedges, truncated pinch-out reservoirs in layers truncated by typical erosional unconformity, and overlap pinch-out reservoirs in basal conglomerates and in detrital zones associated with planes of unconformities.

Depositional Pinch-Out Reservoirs
Truncated Pinch-Out Reservoirs

These two reservoir families are discussed together. In a broad sense, the "depositional pinch-out traps" occur in stratigraphic wedges which represent zones that show convergence by gradual thinning of their members and by successive dropping out of the members in periodical or irregular order, in effect causing a number of unconformable breaks. This is in contrast to stratigraphic zones abruptly cut off by angular unconformities. They contain the "truncated pinch-out traps" sealed by relatively impermeable beds above the unconformity.

The foregoing conditions may occur on a regional scale or on local structures. The East Texas field, as an example of a regional pinch-out trap, is generally described as a truncated pinch-out reservoir in monoclinal position on the flanks of the large Sabine uplift. Typical depositional and truncated pinch-out reservoirs in monoclinal position on the flanks of uplifts (Fig. 2) occur on structures like the "Buried Hill structures" of the Mid-Continent regions, which are the remnants of Paleozoic uplifts more or less leveled off by erosion and then buried under a new blanket of sediments, for example, Oklahoma City field.

In the shallow piercement-type salt-dome structures of the Gulf Coast (Fig. 2), many types of stratigraphic conditions may be developed within a short radial distance on the flanks. Reservoirs are situated in sealed sand members which pinch out (depositional pinch-out reservoirs), as well as in sands truncated by erosional unconformity (truncated pinch-out reservoirs), for example, Jennings field, Louisiana. In addition, the strata flanking the salt plugs are generally cut by radial faults and many pinch-out traps on piercement-type salt domes are therefore combined with fault traps, resulting in reservoirs with double traps, triple traps, and composite traps (Fig. 2).

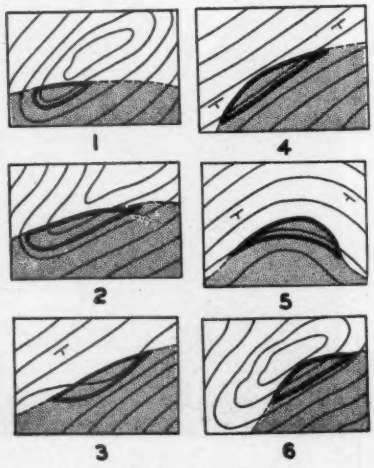


Fig. 1 Pinch-out trap reservoirs

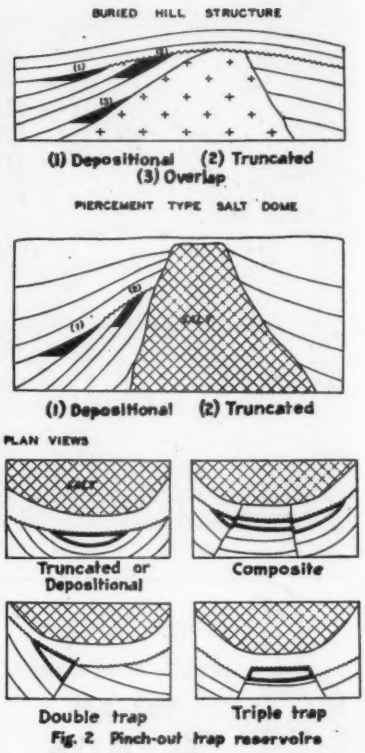
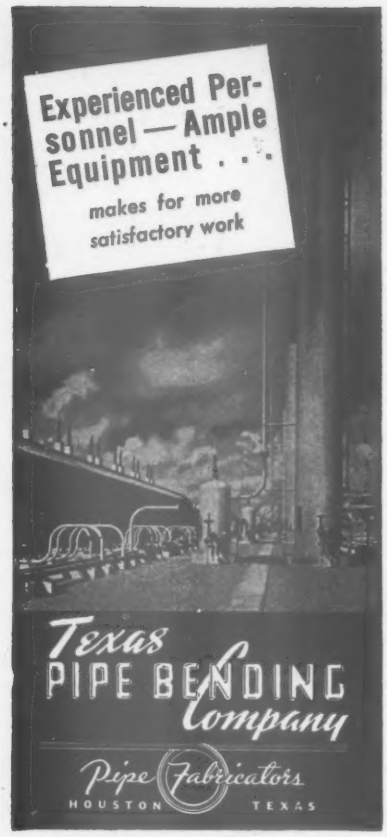


Fig. 2 Pinch-out trap reservoirs

Overlap Pinch-Out Reservoirs

Reservoirs of this type are found in porous conglomeratic material on regional unconformities or at the base of marine overlaps over a basement complex (Fig. 2). The deep productive zone in the Playa del Rey structure, California, is an example of such a reservoir located in a basal conglomerate which pinches out on the plunge of the Franciscan (basement) core of the uplift.

Series prepared by Dr. O. Welhelm, Shell Oil Co., Inc. (A. A. P. G. Bulletin Vol. 29, No. 11)



REFINING

Lubricating Oil Plant To Be Built by Shell

HOUSTON.—A new lubricating oil manufacturing plant, the first complete installation of its type to be built since the end of the war, will be constructed for Shell Oil Co., Inc., adjacent to its Houston refinery.

Construction work will start immediately under contracts awarded to Lummus Co. and M. W. Kellogg Co., according to P. E. Foster, Houston refinery manager. The new plant will be located on 75 acres of a 650-acre tract purchased by Shell last year to provide for postwar expansion.

The new lubricating-oil installation will consist of five separate plants for vacuum distillation, deasphalting, solvent extraction, dewaxing, and chemical treating. When completed, they will be able to completely process high, medium, and low viscosity index lubricating oils from Southwest crudes, Foster said. Additional facilities include storage tanks, loading equipment and 10 buildings for auxiliary installations.

Plans also call for a number of pilot plants to test, under actual operating conditions, improvements in lubricating-oil manufacture which have been developed by laboratory research. A construction program already under way at the Houston refinery includes a 17,000-bbl. capacity catalytic cracking unit, gas recovery, and treating equipment.

Crude Runs of Gulf Coast Plants Show Sharp Drop

HOUSTON.—Crude runs to stills dropped sharply during the last half of March in plants of the Gulf Coast Refiners Association, according to figures of the organization's semimonthly report.

The plants of the association's members were operating at 87.4 per cent of capacity during the last half of February. This fell to 70.7 per cent of the rated 122,000-bbl. daily capacity during the first half of March. Runs were 86,266 bbl. daily, against 110,998 bbl. daily in the last half of February. The decrease apparently reflected a reported Texas crude short-

Here examining a model of a vacuum distillation unit similar to one which will be installed in the new lubricating oil manufacturing plant of Shell Oil Co., Inc., are, left to right, O. M. Morfit, of M. W. Kellogg Co., W. W. Kraft of Lummus Co., and P. E. Foster, manager of Shell's Houston refinery

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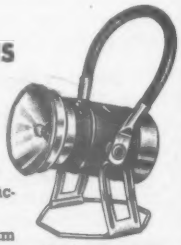

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age resulting from the Texas Railroad Commission's allowable reductions.

Stocks of gasolines, naphthas, and kerosene decreased during the first half of March, while most gas oil and fuel oil inventories increased. Automotive gasoline stocks were 924,227 bbl. March 15, a decrease of 322,258 bbl. A year ago automotive gasoline stocks were 689,535 bbl. Kerosene stocks at 251,542 bbl. showed a decrease of 40,175 bbl. Diesel gas oil stocks March 15 were 113,242 bbl., reflecting an increase of 62,861 bbl. Stocks of No. 5 fuel oil increased 23,946 bbl. to 62,457 bbl. Total stocks of all products in the plants were reported at 3,000,086 bbl. March 15, showing a decrease of 351,177 bbl.

Lion Clears Preliminaries For New Catalytic Unit

EL DORADO, Ark.—Lion Oil Co. has completed preliminary arrangements for construction of a new catalytic cracking unit at its refinery here, filing a 150,000-share common stock offering with the Securities and Exchange Commission and contracting with the Lummus Co. to handle the construction work.

The company told the commission in Philadelphia that approximately $1,250,000 of the net proceeds from the stock offering will be used for the refinery improvement program.

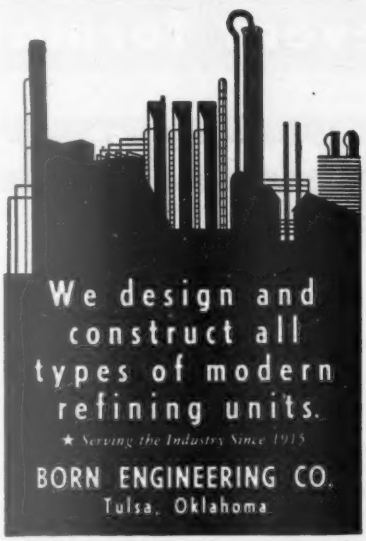
In another announcement disclosing further details of the construction, Lion said the Lummus Co. is scheduled to start work as soon as engineering details are completed and materials obtained. The unit will be a 4,500-bbl. daily capacity thermofor catalytic cracking unit as licensed by Houdry Process Corp. Capable of processing heavy gas-oil charging stocks, it will be of the most recent type, embodying simpification of the kiln elevator system for handling spent and rejuvenated catalyst as well as a reduction in structural requirements as a result of more compact design.

The unit will utilize gas-oil charging stock currently being processed in conventional type thermal equipment. As a result of this type of operation, a high percentage of premium grade burner oil will be produced.

Kansas Cooperative Refinery To Add Furfural Equipment

KANSAS CITY.—Furfural processing equipment will be installed at an estimated cost of $600,000 in the Coffeyville, Kans., lubricating oil refinery of Cooperative Refinery Association, a subsidiary of Consumers Cooperative Association.

Work under the supervision of Emil Geppelt, head of Process Engineers, Inc., Dallas, is scheduled to start immediately with completion in about 9 months, according to Howard A. Cowden, Consumers Cooperative president. Other improvements to be added later are expected to increase total cost of the project to more than $1,000,000. The decision to install the equipment for the solvent treating of oils, Cowden added, resulted from findings of the cooperative's research department.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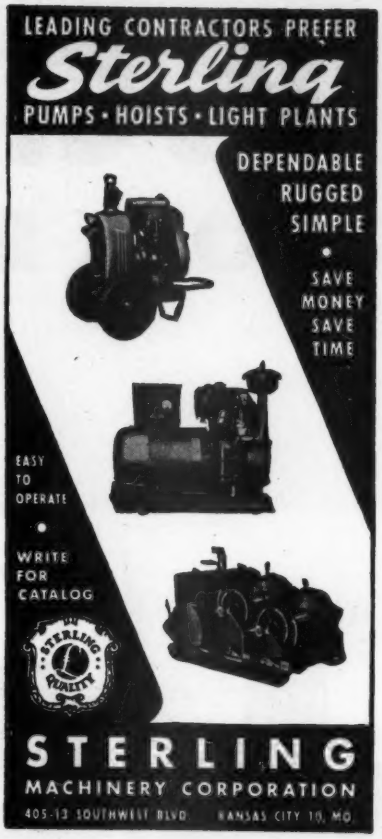

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Natural Gas

Gas Inquiry Hearing Set June 17 in Washington

WASHINGTON.—June 17 has been set as the date for the opening of the Washington hearing in the Federal Power Commission's investigation of the natural-gas industry.

The hearing here is expected to produce some of the most important testimony since the investigation was initiated in September 1944. It follows seven regional hearings held throughout the country, including one which opened this week in Charleston, W. Va.

West Texas Operators Plan Gas Conservation

MIDLAND, Tex. — Gas utilization projects costing more than $50,000,000 and designed to conserve more than 225,000,000 cu. ft. daily of flared casinghead gas were described by West Texas operators before the Texas Railroad Commission here last week.

The commission's session was the third of its four hearings throughout the state on gas conservation. First indication of a crackdown on gas waste following the Corpus Christi and Houston hearings came 2 weeks ago when the commission threatened operators in two fields with shutdowns unless gas utilization plans are launched.

Beauford H. Jester, one of the commissioners, told the group at the hearing that "the whole world knows, including the Federal Power Commission, of the vast wastage of gas in the Permian basin.

"It behooves the industry to make the move to do something about that. California is in dire need of gas, and the commission will not oppose any effort to conserve the flare gas through interstate sale."

Nine projects in fields or parts of fields for pressure maintenance or other forms of gas utilization which will involve an expenditure of $25,000,000 are being considered by Stanolind Oil & Gas Co., C. G. Condra, representing the company, said at the hearing. Stanolind is considering a $7,000,000 injection program in Goldsmith pool. Other fields where Stanolind is planning projects are North Cowden, South Cowden, Foster, Slaughter, Cedar Lake, Hendrick, Fullerton, and Watkins.

Condra, with the concurrence of several other operators at the hearing, told the commissioners that the lack of legal authority for permissive pooling or field-wide utilization is hindering gas conservation programs. He pointed out that this is particularly applicable to participation by the University of Texas and school land groups.

Plans for the construction of a gasoline plant pressure-maintenance system and other facilities for conserving gas in the Slaughter pool were disclosed at the hearing by V. E. Cottingham, chairman of the North Basin Pools Engineering Committee. Cost of this project was placed at $20,000,000, including $5,000,000 for pipe lines.

Gulf Oil Corp. is planning pressure-maintenance studies in every field in which it operates in West Texas, according to Gordon Fisher, engineer for the company.

Testimony at the hearing showed that the greatest West Texas wastage of gas is in Slaughter pool where flare gas there amounts to 43,306,000 cu. ft. daily.

Plans Laid For Annual Gas Measurement Conference

NORMAN.—More than 500 engineers and technical experts representing companies throughout the nation will converge on the University of Oklahoma campus here April 23 to learn of the latest developments in the gas measuring and regulating field.

The occasion will be the twenty-first annual Southwestern Gas Measurement short course held at the university's engineering school with the assistance of the Oklahoma Corporation Commission and the Oklahoma Utilities Association.

The 2-day program will include a series of classes taught by industry representatives. Exhibits of new equipment will be set up for display during the meeting.

Chairmen of committees arranging for the meeting were named recently in Dallas by the general committee. They are: R. M. Schofield, Lone Star Gas Co., program; C. E. Terrell, Southern Natural Gas Co., publications; J. L. Griffin, Northern Natural Gas Co., exhibits; Miss Kate Niblack, Oklahoma Utilities Association, registration and publicity; and W. H. Woods, Gulf Oil Corp., practical methods.

Slight Drop Reported In Natural Gas Sales

NEW YORK.—Natural gas sales in January showed a slight decrease from the same month in 1945 but still stand at 191.5 when compared with the 100 index for the 1935-39 base period.

The American Gas Association reported the natural gas decrease in January at 0.1 per cent. Another decrease of 0.3 per cent was noted for the 12-month period ending January 31 from the corresponding period in 1944-45.

The association measures sales in therms, one of which is roughly equivalent to 100 cu. ft. of natural gas or 170 cu. ft. of manufactured gas. January sales were placed at 2,424,882,600 therms, compared with 2,426,938,800 therms in January 1945. Sales of manufactured and mixed gas increased 1.4 for the month and were unchanged for the 12-month period. January manufactured and mixed sales stood at 177.7 of the 1935-39 base.

Kentucky Line Proposal Set for Hearing May 6

WASHINGTON. — Cincinnati Gas Transportation Co.'s proposal to construct and operate a 70-mile natural gas pipe line in Kentucky will be heard by the Federal Power Commission May 6 in Washington.

Carbon Black Plants for Sale

WASHINGTON.—Five channel-type carbon black plants with a total capacity of 106,200,000 lb. per year are offered for sale by the War Assets Corp. The plants are those located at Guymon, Okla.; Odessa and Sunray, Tex., and Eunice and Monument, N. M.

Natural Gasoline

Warren Petroleum Completes Laboratory Near Houston

HOUSTON.—A new research laboratory for the study of problems connected with natural gasoline and liquefied petroleum gases has been completed by Warren Petroleum Co. at Fairbanks, 12 miles north of here.

The four-room brick structure will serve as a central laboratory for all Warren plants and also as a service laboratory for products of plants marketed by Warren Petroleum. Special studies also will be made of the chemical and blending fluid uses of the lighter hydrocarbon products.

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PIPE LINES

Egypt Wants Terminus of Trans-Arabian Pipe Line

CAIRO.—Officials of the Egyptian Government are seeking to have their country become the Mediterranian terminus of the proposed Saudi Arabian oil pipe line.

The Egyptian Department of Commerce is reported in press accounts here to have recommended to the Cabinet that the Government make representations to the United States and to Saudi Arabia that the line terminate at an Egyptian port. Premier Ismail Sidky Pasha himself advocated such a project before taking office.

A memorandum from the Commerce Department is said to have pointed out the advantages to Egypt of such a location and to have suggested that Egypt provide facilities for the line, erection of refineries and the residence of American technicians in Egypt.

In New York, an official of Standard Oil Co. of California said the location of the terminus is as yet undecided. The proposed 1,000 to 1,200-mile pipe line would be built by Trans-Arabian Pipe Line Co. which is jointly owned by California Standard and The Texas Co. The line with a capacity of 300,000 bbl. daily would tap Arabian American Oil Co.'s Saudi Arabian reserves on the Persian Gulf.

Seven routes for the line were surveyed last year, according to information available in New York. Two would terminate at Tripoli or Beyrouth, capital of Lebanon, with other possible terminals being Haifa, Jaffa, El Arish, Port Said, or Alexandria. At one time, the oil companies reportedly rejected consideration of an Egyptian terminus because of likely heavy taxes levied by the Egyptian Government.

Great Lakes to Extend System by 600 Miles

KANSAS CITY.—A program of new construction involving the laying of more than 600 miles of products pipe line in five midwestern states has been disclosed by Great Lakes Pipe Line Co. here.

The company said materials for the lines and pumping stations were ordered in the late summer of 1945, and that a substantial number of the items have been delivered to warehouses along the routes during the last few months.

An earlier announcement by Sinclair Oil Corp. in New York said arrangements have been completed under which Sinclair's Kansas City refinery will be connected to the Great Lakes system and about 30 per cent of its gasoline output moved by pipe line instead of by rail. Sinclair refineries at Sand Springs, Okla., and Coffeyville, Kans., already are in the Great Lakes system.

The Great Lakes company has let contracts for the construction of an 8-in. 85-mile line between Eldorado and Humboldt, Kans. Work was scheduled to begin this week by A. C. Holder Construction Co. and Williams Brothers Corp. with completion expected in 45 days. For the time being, the company said it will use a pumping station at Eldorado owned by Phillips Petroleum Co., products pipe line division. In the past, Phillips has

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carried the Eldorado traffic of Great Lakes to Kansas City.

Another phase of the program is the laying of an 8-in. 205-mile line between Kansas City and Omaha. Williams Brothers will lay south from Omaha, and Midwestern Constructors south from Falls City, Neb. This project is scheduled to be started April 10 and to be completed in 2 months. Pumping stations will be constructed by D. C. Bass & Sons Construction Co. on the Omaha-Kansas City line at Atchison, Kans.; Falls City, Nebraska City, and Irvington, Neb. An 8-in. line from Omaha to Sioux Falls, S. D., was completed for Great Lakes last year.

The Great Lakes system also will be extended into territory never before served by pipe line when H. C. Price Co. completes construction of 312 miles of 6 and 8-in. line for the company from Sioux Falls northward to Marshall, Willmar, and Alexandria, Minn., west to Fargo, N. D., and north to Grand Forks, N. D. Price Co. officials in Bartlesville, Okla., said they expect to complete the project by September 1.

Monterrey Line Sold to Mexican Gas by United

MEXICO CITY.—Mexican Gas Co. has bought United Gas Co.'s line from Roma, Tex., to Monterrey, Mexico, and is planning to spend $2,000,000 to construct a parallel carrier.

The 14-in. line purchased from United Gas, Shreveport, La., is capable of delivering 45,000,000 cu. ft. daily and will provide the Mexican company with a total daily delivery to Monterrey of 80,000,000 cu. ft. Announcement of plans for the parallel line was made by Prisciliano Elizondo, president of Mexican Gas.

Hearing Set April 8 on Tennessee Gas Proposal

WASHINGTON.—Tennessee Gas & Transmission Co.'s application for approval of its plans to spend nearly $30,000,000 in improving its Texas-West Virginia natural gas pipe line will be heard by the Federal Power Commission here April 8.

The company plans 410 miles of 26 and 24-in. main line loops along the existing 24-in. trunk 18 new compressor units, three new compressor stations in Texas and Louisiana, and 15 miles of feeder lines. Designed to raise capacity of the system from 264,000,000 cu. ft. to 381,000,000 cu. ft. daily, the additional facilities, the company said, are necessary to meet demands of distributing companies it supplies and to service a number of small communities along the line.

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FULL HOLE

SIZE	Tool Joint Diameter O.D.	Tool Joint Diameter I.D.	Tool Joint Length (Approximate)	Diameter of Upset Drill Pipe Diameter of Land	Diameter of Upset Drill Pipe Inside Diameter
*2⅞"	4"	1⅞"	17"	3"	1 1/16"
3½"	4⅝"	‡2 7/16"	18"	3⅝"	2¼"
4"	5¼"	2 13/16"	20"	4⅛"	2 13/16"
4½"	5¾"	†3"	20"	4⅝"	3 5/32"
5 9/16"	7"	**3 13/16"	22"	5 11/16"	4"
6⅝"	8"	5"	24"	6¾"	5"

Note: Acme Full Hole can be furnished in sizes: 3½"-4½" and 5 9/16".
* Reed Full Hole, Not A.P.I. Standard. † 2 13/16" or 3 5/32" Optional.
** 4" Optional ‡ 1⅞" Optional.

SEMI-INTERNAL FLUSH

SIZE	Tool Joint Diameter O.D.	Tool Joint Diameter I.D.	Tool Joint Length (Approximate)	Diameter of Upset Drill Pipe Diameter of Land	Diameter of Upset Drill Pipe Inside Diameter
3½"	4⅞"	2 7/16"	18"	3⅝"	2¼"
4½"	6"	3 5/16"	20"	4⅝"	3 5/32"

Note: The Tool Joint Box and Pin Connections have 4 A.P.I. Threads per inch, with Larger Pin Diameter than A.P.I. Full Hole.

REED *Super Shrink-Grip* TOOL JOINTS FOR INTERNAL FLUSH DRILL PIPE

SIZE	Tool Joint Diameter O.D.	Tool Joint Diameter I.D.	Tool Joint Length (Approximate)	Diameter of Upset Drill Pipe
2⅞"	4⅛"	2⅛"	17"	3¼"
3½"	4¾"	2 11/16"	18"	3⅞"
4"	5¾"	†3"	20"	4⅝"
4½"	6⅛"	3¾"	20"	5 1/32"
5 9/16"	7⅞"	4 13/16"	22"	6⅛"
6⅝"	8½"	5 21/32"	24"	7 3/16"

† 2 13/16" or 3 5/32" Optional.

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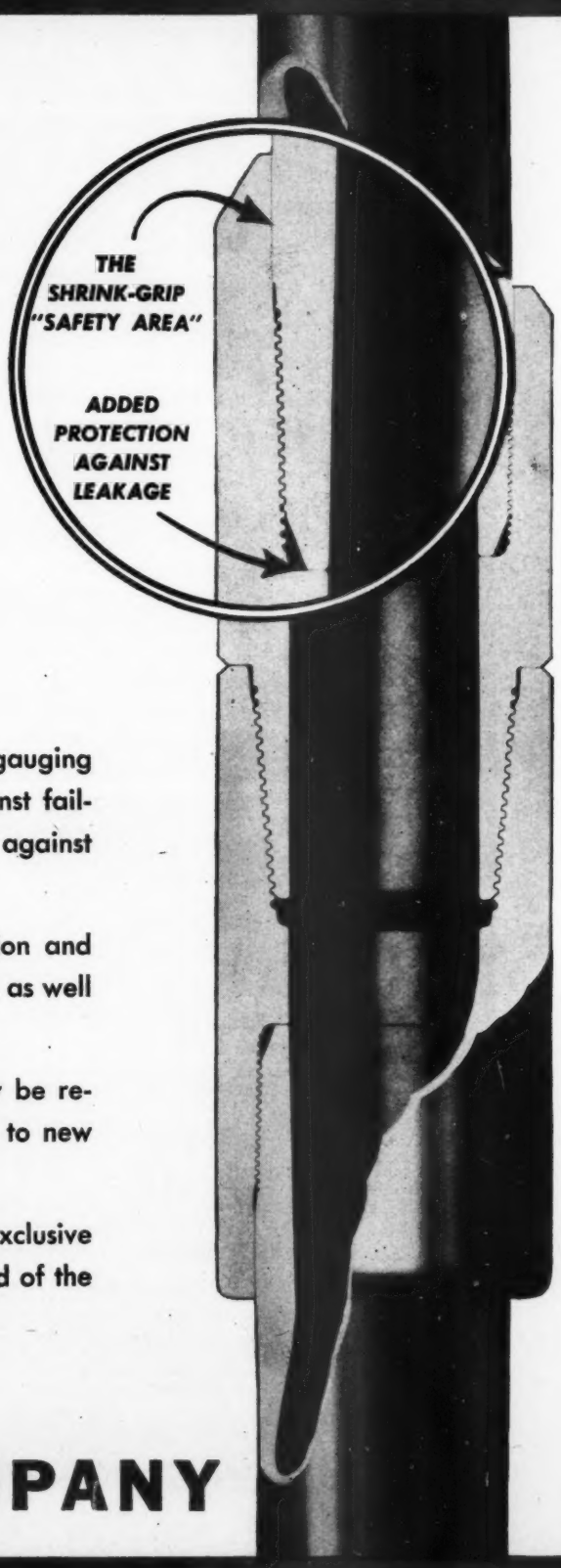

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The Reed "Shrink-Grip" safety area, plus the gauging shoulder in the tool joint, assures full protection against failure at the last engaged thread — and seals the joint against leakage.

Field application or replacement is a simple operation and will save long hauls and excessive transportation costs, as well as possible shut-down time of the rig.

If desired, Reed "Super Shrink-Grip" Tool Joints may be removed undamaged from drill pipe for re-application to new drill pipe.

Give that new string of pipe the advantages that are exclusive to the Reed "Super Shrink-Grip" Tool Joint — standard of the industry.

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STATISTICS and

WEEKLY WELL COMPLETIONS . . . WEEK ENDED MARCH 30, 1946

	Total of all wells					Cum. to date		Wildcat completions and discoveries					Cumulative total, 1946				
	Comp.	Oil	Gas	Dry	Footage	1946	1945	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	31	15	0	*16	52,834	380	270	0	0	0	0	0	0	0	0	0	0
Pennsylvania	69	38	1	†30	114,363	1,011	854	0	0	0	0	0	0	0	0	0	0
West Virginia	16	0	14	2	41,563	170	184	0	0	0	0	0	0	0	0	0	0
Ohio	25	5	13	7	66,665	264	176	0	0	0	0	0	1	0	7	11	19
Indiana	3	3	0	0	5,561	68	41	0	0	0	0	0	1	0	0	6	7
Kentucky	9	5	3	1	15,657	102	87	0	0	0	0	0	1	0	0	14	15
Illinois	49	25	0	24	121,001	475	392	1	0	0	6	7	10	0	0	78	88
Michigan	7	0	1	6	20,173	155	178	0	0	0	6	6	3	0	0	55	58
Kansas	28	16	2	10	95,243	496	360	0	0	0	5	5	6	0	1	58	65
Neb., Mo., Iowa	0	0	0	0	0	4	11	0	0	0	0	0	0	0	0	2	2
Oklahoma	44	20	7	‡17	150,220	592	560	0	0	0	9	9	17	0	9	84	110
Texas	162	102	10	50	722,365	1,908	1,704	11	3	0	26	40	44	8	5	291	348
North Central	48	26	0	22	134,578	648	473	4	0	0	10	14	15	0	0	108	123
West	36	31	0	5	169,122	410	457	3	0	0	5	8	10	0	0	50	60
Panhandle	6	2	2	2	17,830	92	135	0	0	0	0	0	0	0	0	2	2
Eastern	19	13	1	5	93,028	186	73	2	0	0	2	4	4	0	1	28	33
Gulf Coast	43	26	7	10	275,103	441	406	2	3	0	5	10	11	6	2	63	82
Southwest	10	4	0	6	32,704	131	160	0	0	0	4	4	4	2	2	40	48
Louisiana	34	15	4	15	263,959	312	223	3	0	0	6	9	16	2	1	40	59
Northern	14	8	4	2	83,727	157	71	0	0	0	2	2	2	0	0	23	25
Southern	20	7	0	13	180,232	155	152	3	0	0	4	7	14	2	1	17	34
Arkansas	3	2	0	1	10,031	40	35	0	0	0	1	1	2	0	0	7	9
Mississippi	6	2	0	4	44,667	60	75	0	0	0	4	4	1	0	1	19	21
Southeastern States	1	0	0	1	1,925	12	7	0	0	0	1	1	0	0	0	11	11
Montana	5	4	1	0	7,565	60	66	0	0	0	0	0	2	0	0	3	5
Wyoming	1	0	0	1	7,450	47	49	0	0	0	1	1	5	0	2	17	24
Colorado	1	1	0	0	6,235	25	6	0	0	0	0	0	1	0	0	4	5
New Mexico	12	7	0	5	38,227	100	123	0	0	0	2	2	2	0	0	9	11
California	43	34	0	9	192,756	447	573	0	0	0	9	9	4	0	2	56	62
Utah	0	0	0	0	0	2	1	0	0	0	0	0	1	0	0	1	2
Total United States	549	294	56	199	1,978,460	6,730	5,975	15	3	0	76	94	117	10	28	766	921
Total previous week	531	299	45	187	1,787,417	6,181	5,543	10	2	3	69	84	102	7	28	690	827
Total March 31, 1945	432	236	44	152	1,508,434	5,975	4,641	8	1	1	47	57	154	4	34	769	961

Service wells included: *16, †29, ‡1.

MARKET QUOTATIONS

(Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gal. as of last Monday.)

REFINERY GASOLINE

Octane (A.S.T.M.)	78-80†	73-75
Mid-Continent*	6.00-6.25	5.25-5.50
Texas Gulf Coast	6.375	5.375-5.75
New York Area		7.425-7.90
California		6.00-6.875

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	2.750	3.300
N. Texas (f.o.b. plant)	2.250	2.700
N. Louisiana (f.o.b. plant)	2.625	3.150
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.

East Texas	$1.35
Conroe	1.53
Tepetate, Louisiana, avg. grav.	1.30
Illinois Basin	1.47
Pecos County, Texas	1.05
Bradford, Pennsylvania	3.10
Van, Van Zandt County, Texas	1.18

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Texas	West Tex.*
18-18.9	$0.90	....	....	....
19-19.9	.94	....	$1.16	$0.80
20-20.9	.98	$0.95	1.18	.82
21-21.9	1.02	.97	1.20	.84
22-22.9	1.06	.99	1.22	.86
23-23.9	1.10	1.01	1.24	.88
24-24.9	1.13	1.03	1.26	.90
25-25.9	1.17	1.05	1.28	.92
26-26.9	1.21	1.07	1.30	.94
27-27.9	1.25	1.09	1.32	.96
28-28.9	1.28	1.11	1.34	.98
29-29.9	1.30	1.13	1.36	1.00
30-30.9	1.33	1.15	1.38	1.02
31-31.9	....	1.17	1.40	1.04
32-32.9	....	1.19	1.42	1.06
33-33.9	....	1.21	1.44	1.08
34-34.9	....	1.23	1.46	1.10
35-35.9	....	1.25	1.48	1.12
36-36.9	....	1.27	1.50	1.14
37-37.9	....	1.29	1.52	1.16
38-38.9	....	1.31	1.54	1.18
39-39.9	....	1.33	1.56	1.20
40 and above	....	1.35	1.58	1.22

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended March 23, 1946

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks Gasoline	Distillate	Residual
East Coast	756	23,285	8,346	5,850
Appalachian	155	4,149	516	504
Ill., Ind., Ky.	718	24,072	3,098	3,151
Okla., Kan., Mo.	386	10,119	1,416	1,008
Inland Texas	224	3,132	297	636
Tex. Gulf Cst.	1,148	15,659	4,327	4,139
La. Gulf Cst.	312	4,351	1,348	1,157
No. La., Ark.	51	1,881	394	237
Rocky Mtn.	140	2,550	435	633
California	793	15,364	6,490	20,591
Total 3-23-46	4,683	104,562	26,667	37,906
Total 3-16-46	4,607	104,781	25,747	37,767
Total 3-24-45	4,720	98,193	26,324	42,920

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
March 23, 1946	225,153,000
March 16, 1946	226,233,000
March 24, 1945	221,227,000

*Excludes unrefinable Calif. stocks.

TRENDS

DAILY AVERAGE PRODUCTION FOR WEEK

	Mar. 30 crude oil	Bureau of Mines March demand	Mar. 23 crude oil
Alabama	950	500	1,000
Arkansas	77,050	76,000	77,250
California	855,250	838,000	859,750
Colorado	23,460	23,000	22,200
Eastern	63,650	61,200	65,100
Florida	100	100	100
Illinois	211,900	198,000	208,600
Indiana	18,400	13,000	17,600
Kansas	253,200	252,000	259,350
Kentucky	32,300	29,000	32,050
Louisiana	377,200	372,000	375,800
North Louisiana	83,850	.....	82,450
South Louisiana	293,350	.....	293,350
Michigan	46,920	46,000	44,270
Mississippi	57,000	52,000	55,250
Montana	23,440	20,400	23,710
Nebraska	750	800	800
New Mexico	95,150	98,000	95,150
Oklahoma	365,200	366,000	367,500
Texas	1,817,450	1,910,000	1,817,450
East Texas	317,400	.....	317,400
East Central Texas	127,500	.....	127,500
North Central Texas	146,050	.....	146,050
Texas Panhandle	81,000	.....	81,000
West Texas	436,500	.....	436,500
Southwest Texas	290,200	.....	290,200
Texas Gulf Coast	418,800	.....	418,800
Wyoming	98,000	94,000	100,270
Total United States	4,417,370	4,450,000	4,423,200
Change from previous week	down 5,830		

Total production January 1-March 30 ..... 414,852,060 bbl.
Same period last year ..... 422,461,850 bbl.

CRUDE-OIL STOCKS 225,153,000 bbl. as of March 23—down 1,080,000 bbl. One year ago 221,227,000 bbl.

GASOLINE STOCKS 104,562,000 bbl. as of March 23—down 219,000 bbl. One year ago 98,193,000 bbl.

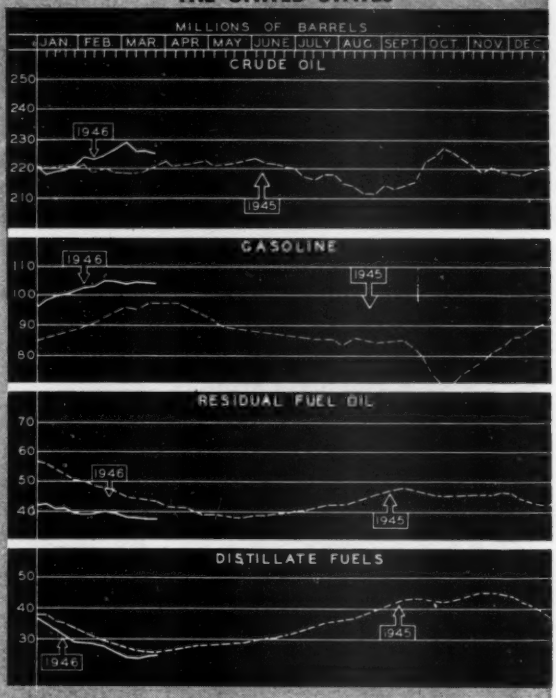
RESIDUAL FUEL-OIL STOCKS 37,906,000 bbl. as of March 23—up 139,000 bbl. One year ago 42,920,000 bbl.

GAS OIL AND DISTILLATE STOCKS 26,667,000 bbl. as of March 23—up 920,000 bbl. One year ago 26,324,000 bbl.

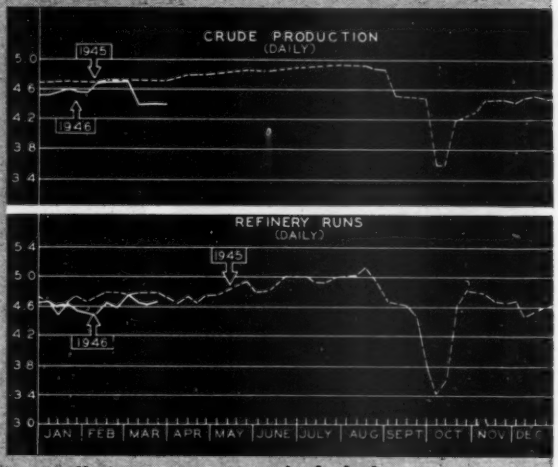
CRUDE-OIL PRODUCTION 4,417,370 bbl. as of March 30—down 5,830 bbl. One year ago 4,776,900 bbl.

REFINERY RUNS 4,683,000 bbl. daily week ended March 23—up 76,000 bbl. One year ago 4,720,000 bbl.

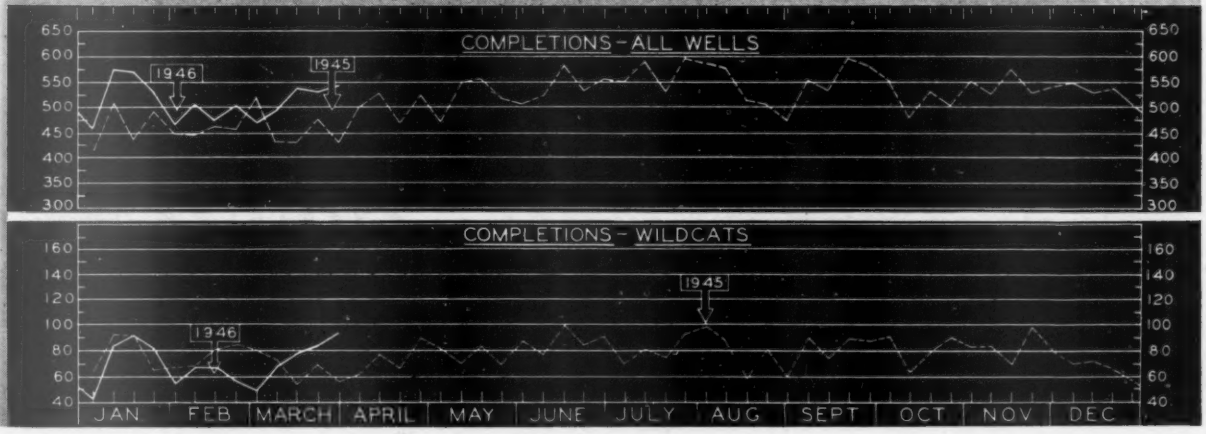
OIL STOCKS IN THE UNITED STATES



DAILY OPERATIONS

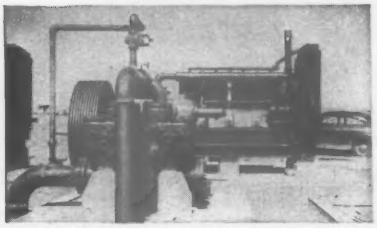


Solid line charts weekly completions, service wells in Eastern area included

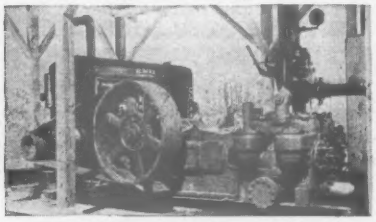


CLIMAX BUILDS GREAT ENGINES FOR *Tough* OIL FIELD JOBS

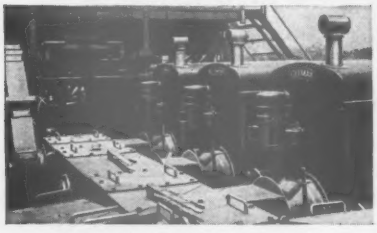
PICTURES TELL THE STORY!



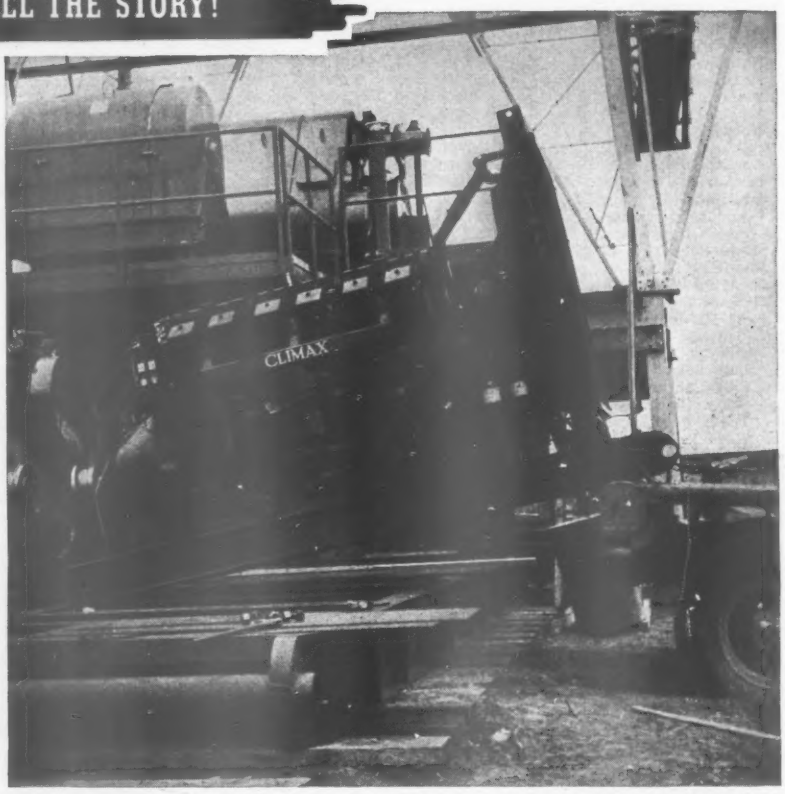
CLIMAX R8I Provides Dependable Power for Pipe Line Pumping



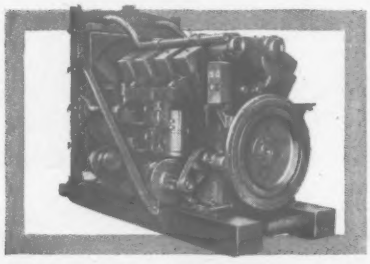
CLIMAX R6I Engine Driving Slush Pump



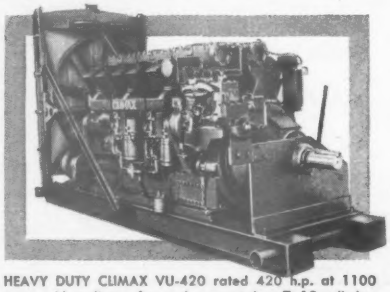
3 Husky CLIMAX R6I's On Drilling Rig



CLIMAX VU-420 GOING ON THE JOB—TO DO A JOB—AND KEEP ON DOING IT



NEW COMPACT CLIMAX VU-280 rated 280 h.p. at 1100 r.p.m. with radiator, fan and auxiliary equipment. 8 cylinder, 4-cycle "V" type, 60°



HEAVY DUTY CLIMAX VU-420 rated 420 h.p. at 1100 r.p.m. with radiator, fan and power take-off. 12 cylinder, 4-cycle, "V" type, 60°.

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Exploration and Drilling

Mississippi Has Problems

WHILE no one will deny that Mississippi has a great future as an oil producing state, currently the developments there are repeating an old pattern of alternating optimism from apparently important discoveries followed by pessimism, when unfavorable results appear.

Since the first of the year, two important wildcats each week have seemed on the verge of opening up a new field apiece. These tests are the Phillips Petroleum Co. 1 Davey, irregular Section 46-8n-2w, and Roeser and Pendleton-Sohio Petroleum Co. 1 Baker-Maier, Section 34-6n-2w, both in Adams County, in western Mississippi.

Both have produced small volumes of light-gravity oil from time to time on tests, and neither has been able to eliminate salt water. Squeeze and reperforation jobs, followed by new tests mark the history of both wells since the first of the year. At this time, no one cares to make any predictions about final completion results, except that on the basis of showings to date, there ought to be clean oil somewhere in the section.

One lies northwest of the Cranfield pool, the other southwest. Both are in the general area comprised of parts of eastern Louisiana and western Mississippi, where Lake St. John, Cranfield, and other pools have indicated a general petroliferous district. Both have also run true to form for this area in that the oil they have found has been high gravity, whereas farther east in Mississippi, heavy-gravity oil has been the rule. In both wells there has been some difficulty in tying down the exact intervals of the sand section to be tested.

What it all boils down to is the fact that finding oil is rarely a simple proposition. The general requirements are: (1) A favorable petroliferous region—oil is present in the area, regardless of the hows and whys of origin and accumulation; (2) There must be a favorable reservoir bed, sand or lime, the porosity and permeability must be right; (3) There must be a trap of some kind to hold and concentrate the oil; (4) All these must combine in one spot.

It seems that in this part of Mississippi, the first and third conditions are present. Oil fields have been found —these wells show oil. Salt domes are reasonably plentiful to form traps and both of these wells are probably on such traps. So the problem resolves itself into one of sedimentation. Where, how and why, will sand conditions be right?

ILLINOIS

Gallatin County Wildcat Recovers Gas and Oil

MATTOON.—Gallatin County may soon have its first new oil field in many months about 2 miles south of Omaha, where the R. B. Martin et al 1 Pioneer Trust & Savings Bank, NW NE SE 2-8s-8e, recovered gas and oil on a drill-stem test of the lower O'Hara. On a 1-hour test of saturation at 2,847-63 ft., recovery was gas in 10 minutes, 30 ft. of oil, 55 ft. of oil slightly cut with mud, and no water. Bottom-hole pressure during the test was 1,150 lb. This well, 2 miles east of producing wells in the Omaha pool, is now drilling ahead below 2,873 ft.

On the extreme eastern edge of the Clay City Consolidated field, Wayne County, the Olson Drilling Co. 1 Elizazeth Lewis, E½ NE SE 36-2n-8e, is flowing natural at the rate of 30 bbl. of oil an hour from the Rosiclare limestone at 3,068-78 ft., total depth 3,079 ft. A few other good wells have recently been completed in this area.

The Storms pool of White County has been slightly extended to the northeast with the completion of Nash Redwine 1 Upchurch, SW SW NE 7-7s-10e. The 1 Upchurch pumped 68 bbl. of oil per day from the Tar Springs sand at 2,304-13 ft. following a 73-qt. shot at 2,305-16 ft., total depth 2,318 ft.

Exploration again appears to be on an upward trend in Illinois with the announcing of 18 new wildcat tests during the past week. These tests were scattered throughout the basin area. In addition, 29 development wells appeared on reports for the first time. Coles County led with 13 new operations, and followed by Wayne County with 6. Coles County continued to hold its lead with the largest number of active operations under way at the present time. Considerable development is also under way in Clay, Wayne, White and Hamilton counties.

Of the 49 completions reported during the week, 25 were oil wells and 24 were dry. Seven wildcats were completed and all were dry with the exception of an extension well in White County.

ILLINOIS SUCCESSFUL WILDCAT

White County: Nash Redwine 1 Upchurch, SW SW NE 7-7s-10e, pumped 68 bbl., Tar Springs sand 2,304-13 ft., 73-qt. shot 2,305-16 ft., TD 2,318 ft.

ILLINOIS WILDCAT FAILURES

Clinton County: C. R. Winn 1 Greffert, NW NW NW 15-2n-1w, dry at 1,499 ft., Glen Dean 1,153 ft., Golconda 1,217 ft., Barlow 1,291 ft., Cypress sand 1,335 ft., Benoist 1,473 ft., Benoist sand 1,482 ft.

Cumberland County: E. Connelly 1 R. E. Carroll, NE SE SE 24-10n-9e, dry at 2,497 ft., Glen Dean 2,004 ft., Barlow 2,098 ft., Cypress sand 2,160 ft., Benoist sand 2,273 ft., Aux Vases sand 2,323 ft., Ste. Genevieve 2,357 ft., Rosiclare 2,393 ft., Fredonia 2,405 ft., St. Louis 2,490 ft.

Macoupin County: J. Q. Gill 1 Parker, NE NE NE 20-10n-9w, dry at 612 ft.

Marion County: J. T. Crowder 1 W. L. Hotha, NW SW NW 34-4n-2e, dry at 2,341 ft., Kincaid 1,392 ft., Vienna 1,585 ft., Tar Springs sand 1,590 ft., Glen Dean 1,706 ft., Cypress sand 1,894 ft., Benoist 2,026 ft., Aux Vases sand 2,090 ft., Ste. Genevieve 2,165 ft., Rosiclare 2,185 ft., McClosky 2,320 ft.

St. Clair County: T. R. Kerwin 1 Scharf, NW SE NE 4-1s-9w, dry at 1,250 ft., Maquoketa 1,066 ft., Trenton 1,213 ft.

Washington County: W. F. Lacey 1 W. M. Rankensmeyer, SW SE NE 10-2s-1w, dry at 1,404 ft.

N. CENTRAL TEXAS

New Caddo Pool Found In Montague County

WICHITA FALLS.—Youngblood and Foree 2 Joe Benton, A. A. Lewis Survey, Abstract 420, wildcat discovery 3 miles northwest of Stoneburg, Montague County, has been completed to flow 261 bbl. of oil in 2 hours through ¾-in. choke. Production is from the Caddo through perforations from 6,132-42 ft. Gravity was 45° and gas-oil ratio 1,500 to 1. S. D. Johnson 1 Willis, S. Cary Survey, southeastern Montague wildcat 2½ miles north of Forrestburg, will reperforate the Marble Falls after test from 7,286-7,304 ft. returned salt water. Total depth is 7,404 ft. Continental Oil Co. will drill a 7,600-ft. wildcat 1½ miles north of Bowie, Montague County. It is 1 Lynn Garlington, 660 ft. from the west line and 1,550 ft. from the north line of Section 3422, TE&L Survey, Abstract 811.

L. T. Burns 1 J. E. Ford, Block 3221, TE&L Survey, opened Caddo oil production ¾ mile northeast of the discovery well in the Heard Ellenburger pool of southern Clay County, 3 miles southwest of Buffalo Springs. It was completed to flow 70 bbl. of oil in 3 hours through a ½-in. choke. It is producing through perforations from 5,750-60 ft. Caddo was topped at 5,751 ft. The well was a failure in the Ellenburger.

Denver Production & Refining Co. 1 Jewell, Wm. Allen Survey, deep test 6 miles southeast of Gordonville, Grayson County, set 4½-in. slotted liner at plugged-back depth of 8,717 ft., swabbed through perforations from 8,580-8,640 ft. and showed a slight amount of oil. Packer was set at 700 ft. and swabbed to 2,000 ft. Recovery was salt water and drilling mud. Operator is attempting to shut off water. H. W. Snowden 1 A. M. Bryant Estate is a new wildcat 2 miles northwest of Whitewright in Grayson County. It is to be drilled to 6,000 ft. It is 1,768 ft. from the north line and 1,060 ft. from the east line of Bryant

273.57-acre tract in the E. M. Jones Survey, Abstract 623.

Electra and KMA fields, Wichita County, each had four completions this week; Gatewood field, Cooke County, had three, and Hildreth and Bowers fields, Montague County, and Wilson field, Cooke County, each had two. Gatewood and Wilson fields each had two locations as did Thomas and Daume fields, Archer County, and Rogers field, Montague County. Daume field, Archer County; Knox field, Young County; Sivells Bend, Cooke County, each have seven drilling wells; National field, Wilbarger County, five, and Hildreth field and Lupton field, Young County, each four.

No field completions or field locations were reported in West Central Texas this week. Stephens County Regular field has five drilling wells; Reddin field, Taylor County; Eastland County Regular field; Loving field, Stephens County, and Palo Pinto field each had two.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: D. H. Bolin 1-B John Purcell, Blk. 102, Jefferson CSL, 3 mi. N and 1½ mi. E Anarene, dry, TD 1,215 ft.

Bridwell Oil 1 E. A. Debus, Sec. 2, SPRR Sur. A-1202, 1½ mi. W and ½ mi. S Holliday, dry, TD 2,010 ft.

Fain & McGaha 1 Jones & Cullum, Sec. 2, SPRR Sur. A-1255, 1½ mi. E Mankins, elev. 1,105 ft., dry, TD 4,400 ft.

Cooke County: R. B. Hollandsworth 1 J. Tischler, Nathan Barnett Sur. A-124, 2½ mi. E and 3 mi. N Muenster, dry, TD 1,268 ft.

Jack County: Hanlon-Buchanan et al 1-E W. M. Crowley, Sec. 1, SPRR Sur. A-579, 3 mi. E and 4 mi. S Antelope, dry, TD 620 ft.

Wichita County: Akin & Dimock 1 J. H. McDonald Hrs., Blk. 305, Waggoner Colony Lands, 3 mi. N and E Electra, dry, TD 2,352 ft.

Montague County: Continental 1 Mrs. S. B. Harvey, Sec. 2880, TE&L Sur., 2½ mi. W and ½ mi. S Bowie, elev. 1,075 ft., Viola 6,778 ft., Ellenburger 7,030 ft., dry, TD 7,075 ft.

Wilbarger County: Paradise Oil Co. 1-H Waggoner, Sec. 5, Blk. 17, H&TC Sur., 6 mi. W and 4½ mi. N of SE corner of county, dry, TD 4,575 ft.

WEST CENTRAL TEXAS SUCCESSFUL WILDCATS

Coleman County: New oil pool—Fullwiler & Hughes Drilling Co. et al 1 Templeton, Sec. 8, Blk. 1, HT&B Sur., 1 mi. NW Silver Valley, elev. 1,954 ft., flowed 1,680 bbl. day through 30/64-in. choke, perf. 3,457-87 ft. Gray, gravity 45°, gas-oil ratio 824 to 1, TD 3,487 ft.

Jones County: New oil pay—S. B. Roberts 6 O. J. Cooper, Sec. 29, Blk. 15, T&P Sur., Cooper-Roberts pool, elev. 1,700 ft., flowed 237 bbl. day, perf. 2,317-30 ft. Gunsight, gravity 37°, TD 2,342 ft.

Shackelford County: New oil pool—Hedrick Oil Co. et al 1 Dawson & Conway, ETRR Sur. No. 195, 5 mi. NE Leuders, elev. 1,636 ft., pumped 21 bbl. day, perf. 1,561-68 Saddle Creek, gravity 36.6°.

New oil pool: Phillips Pet. 1 Pan-Ace, Sec. 16, Lunatic Asylum Land, 1½ mi. W Sedwick, elev. 1,355 ft., flowed 1,420 bbl. day through ½-in. choke, perf. 4,211-20 ft. Ellenburger, gravity 44.8°, gas-oil ratio 409 to 1, TD 4,220 ft.

WEST CENTRAL TEXAS WILDCAT FAILURES

Brown County: Worth Thomason 1 W. A. Leslie, Sec. 36, H&TC Sur., 4 mi. N Bangs, elev. 1,450 ft., dry, TD 1,344 ft.

Jones County: Alder Oil Co. et al 1 J. J. Steele et al, Sec. 6, Blk. 2, T&NO Sur., 5 mi. SE Anson, elev. 1,743 ft., Gunsight 2,398 ft., dry, TD 2,648 ft.

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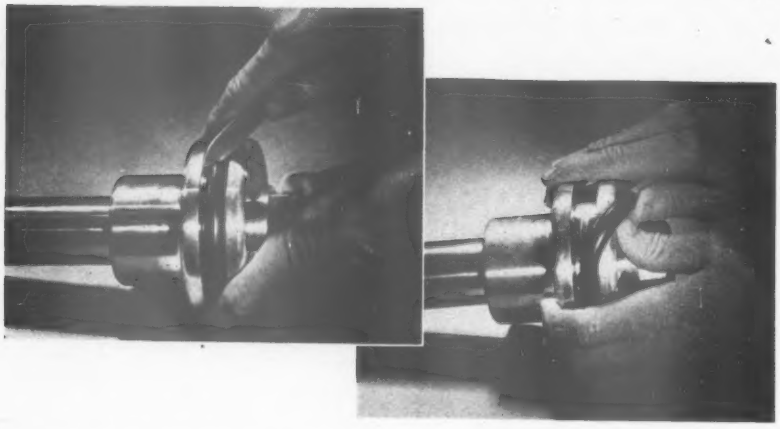

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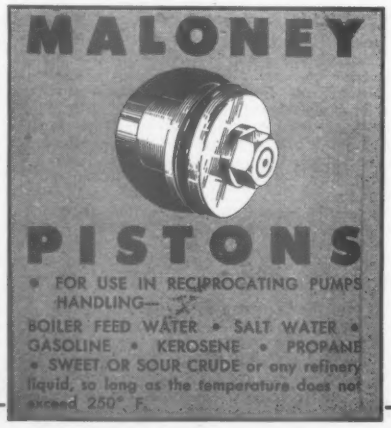
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EASTERN TEXAS

Marion Discovery Flows On Drill-Stem Test

DALLAS.—Magnolia Petroleum Co. 1 S. L. Orr, B. Fowler Survey, 3½ miles southwest of Avinger, Marion County, perforated casing in the Cotton Valley from 9,935-45 ft. with 24 shots. On a 75-minute drill-stem test on perforations recovery was 810 ft. of gas-cut mud. There was no salt water. Operator squeezed perforations and will reperforate higher. Total depth is 10,513 ft.

Humble Oil & Refining Co. 1 Pickering, Francois Survey, wildcat in the Huxley area of eastern Shelby County, plugged back from total depth of 12,221 ft. to 7,130 ft. Elevation is 247 ft. It has been completed to flow 4,500,000 cu. ft. of gas and 65 bbl. of 57-gravity distillate on open flow through perforations from 6,606-28 ft.

Humble 1 Poole, Wm. Sanders Survey, Abstract 878, 4½ miles west and slightly south of Mt. Sylvan, Smith County, has rigged up separator and may test. Total depth is 7,765 ft. and elevation is 454 ft. Edward Pace et al 1 Johnson is a new Paluxy wildcat for Smith County 4 miles southwest of Mt. Sylvan and about 1 mile southeast of Humble 1 Poole. It is 482 ft. south of the north line and 451 ft. west of the east line of the R. E. L. Johnson tract in the A. Kent Survey. Drilling has started on the test.

Hawkins field, Wood County, had five completions this week and the East Texas field had two. Hawkins field has three locations and Pickton field, Hopkins County, had one. Hawkins field has 23 drilling wells; Carthage field, Panola County, 21; New Hope field, Franklin County, 7; Sand Flat field, Smith County, 6; Waskom field, Harrison County, 5, and Pickton field, 4.

EASTERN TEXAS SUCCESSFUL WILDCATS

Henderson County: New oil pay—Lone Star

Prod. 1 Ira Buckalew, Adrian Anglin (N) Sur., Opelika field, elev. 454 ft., flowed 330 bbl. day through ¼-in. choke, perf. 8,827-53 ft. Rodessa, gravity 41.9°, gas-oil ratio 1,228 to 1; also completed in Pettit for 35,000,000 cu. ft. gas day (regular pay), TD 9,500 ft.

Rusk County: New gas-distillate pool—Delta Drlg. 1 C. C. Rayford, James Smith Sur., 3 mi. S of Henderson, elv. 390 ft., flowed 22 bbl. distillate with 1,035,000 cu. ft. day through 3/16-in. choke, perf. 7,310-25; 7,345-54; 7,362-85, and 7,445-64 ft., Travis Peak, gravity 61°, TD 7,515 ft.

EASTERN TEXAS WILDCAT FAILURES

Bowie County: J. W. Murray et al 1 Winnie Fort et al, L. Peters Sur., 2 mi. NE Hooks, dry in Comanchean, TD 3,018 ft.

Rusk County: Jno. Bunn et al 1 W. J. Weatherby et al, W. H. Walters Sur., 1 mi. SW Salem, elev. 287 ft., Woodbine 3,892 ft., dry, TD 3,976 ft.

SOUTHWEST TEXAS

DeWitt-Lavaca Discovery Gages 38 Bbl. on Choke

CORPUS CHRISTI.—Pure Oil Co. 1 E. F. Karl, discovery of first oil production in the new Yoakum field of DeWitt County on the DeWitt-Lavaca County line, was gaged at 38 bbl. net oil per day through a ¼-in. choke, making 52 per cent water. Gas-oil ratio was 20,868 to 1. The oil is 37 gravity, and pressure was 3,100 lb. on tubing, 1,100 lb. on casing, flowing through perforations at 8,663-65 ft. in the Wilcox zone. Total depth was 11,334 ft. Hole was plugged back to 8,667 ft. for completion. This is a new deeper pay for the field, the discovery well was completed through perforations at 8,160-90 ft., flowing 52-gravity condensate. The 1 Karl is the second test for the field, being ½ mile south of the discovery and about 3 miles southeast of the Yoakum townsite, in DeWitt County, just southwest of the Lavaca County line, in John May Survey, Abstract 329.

Humble Oil & Refining Co. 1 Moursund, oil discovery well at Jourdanton field in Atascosa County, and 1 mile southwest of Jourdanton, is preparing to pump for completion after swabbing down to bottom and making 45 per cent oil on the recovery, following acidization. Total depth is 7,385 ft., in Edwards lime. This well is northeasterly from the 1 Schorsch, gas discovery well and first producer in the area, and is in Edward Estes Survey 1188. On a previous test at 7,379 ft. flow gaged 29 bbl. of 34-gravity oil and 7 bbl. of wash water in 12 hours through 3/16-in. choke with tubing pressure of 200 lb., gas-oil ratio 3,160 to 1, but the flow died and the hole was deepened to 7,385 ft. before going on pump. Humble has made location for third test at Jourdanton, about 4,100 ft. southwest of the 1 Schorsch well. The test is 1 Alamo Lumber Co. in southeast corner of Lot 35, Natascosa Colony Farm Subdivision, Edwards Estes Survey 1188. It will also be a 7,400-ft. Edwards lime test.

New oil pay was discovered in the second test drilled in the North Minnie Bock field in Nueces County, by Atlantic Refining Co. 2 Jas. Ewing, which gaged 188 bbl. of 37-gravity oil per day through a 5/32-in. choke, no water, and gas-oil ratio of 897 to 1. Tubing pressure is 1,126 lb., and casing pressure 2,100 lb. Flow is through perforations at 6,229-35 ft. in a new pay level. Total depth is 8,495 ft. and 7-in. casing is on bottom.

Ogden B. Klein 1 D. E. Smith, wildcat in L. D. Sowell Survey, 7 miles southeast of Lockhart in Caldwell County, is preparing to run a production test. It was drilled to a total depth of 2,674 ft. in the Edwards lime. Austin chalk was topped at 2,188 ft., Edwards lime at 2,665 ft. Cuttings are reported to have showed oil.

David S. Ring and Raymond I. Arsht 2 Joe L. Matthews, wildcat test in Zavala County, 6 miles west of La Pryor, showed heavy asphaltic oil in the Olmos sand in cores. Total depth is 2,230 ft., and 7-in. casing has been set on bottom for the production test.

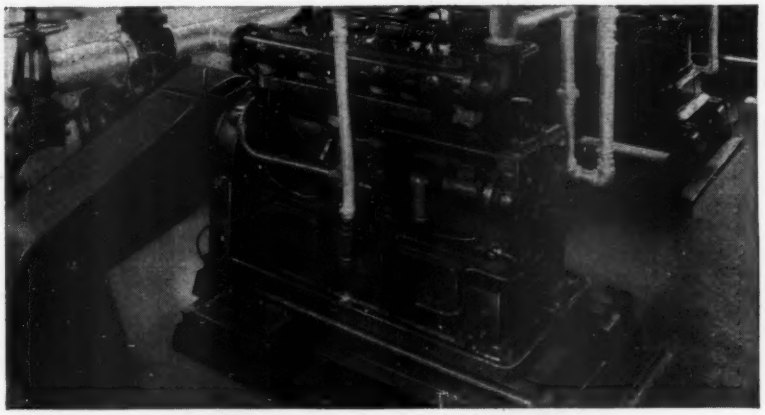
New locations totaled 45 with 6 wildcats, 2 in Webb, and 1 each in Bandera, Jim Wells, Nueces, and Starr counties. Agua Prieta field in Duval County received five new locations, with Pearsall in Frio County; Bonnie View in Refugio County, and Aviator in Webb County, each receiving two. There were 33 completions reported this week. Two new oil sands were opened, each in DeWitt County and Nueces County. One gas-condensate pool was discovered in Victoria County. Eight dry wildcats were reported, two in Live Oak, and one each in Bexar, Brooks, Guadalupe, San Patricio, Starr, and Webb counties.

SOUTHWEST TEXAS SUCCESSFUL WILDCATS

DeWitt County, new oil pay, Yoakum field—Pure Oil Co. 1 A. F. Karl, John May Survey, Abst. 329, TD 11,334 ft., PB 8,667 ft., perf. 9 holes 8,663-65 ft., PT net 38 bbl. oil per day through ⅛-in. choke, TP 2,100 lb., CP 1,100 lb., gas-oil ratio 20,868 to 1, gravity 37°, 52 per cent water.

Nueces County: New oil pay, North Minnie Bock field—Atlantic Refg. Co. 2 James E. Ewing, 3 mi. SW of Robstown, in M. Lopez de Herrera Grant, top pay 6,218 ft., TD 8,495 ft., PB 6,240 ft., perf. 40 holes, 6,229-35 ft., PT 188 bbl. per day through 5/32-in. choke, gas-oil ratio 1,364 to 1, TP 1,260 lb., CP 2,100 lb., gravity 37°, no water.

Victoria County: New gas-condensate pool, Welder Ranch—Sterling Oil & Rfg. Co. 2 J. J. Welder, in S. A. Belding Sur., Abst. 141, 7½ mi. E of Nursery, top



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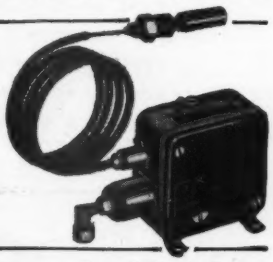
TYPICAL FUNCTIONS OF PENN SAFETY CONTROLS

Diesel Applications. Sounds an alarm only . . . closes magnetic fuel valve and sounds alarm . . . closes magnetic fuel valve only . . . closes magnetic fuel valve and opens pilot relay.

Battery Ignition Applications. Opens battery circuit and sounds an alarm . . . sounds an alarm only . . . opens battery circuit only.

Magneto Ignition Applications. Sounds an alarm only . . . grounds single or dual magneto . . . grounds magneto and sounds an alarm or lights a signal light.

Dual Ignition Applications. Opens battery circuit and grounds magneto.



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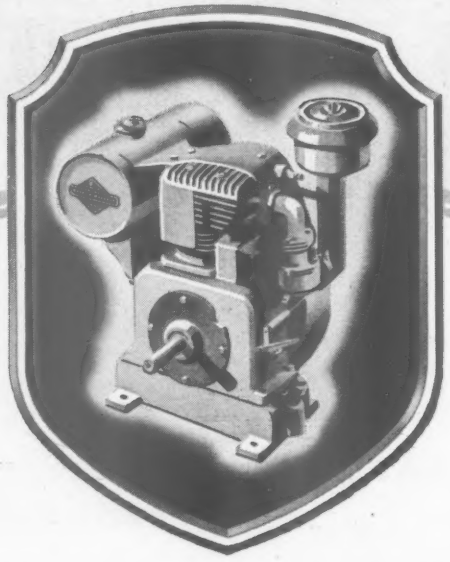

LOOK with confidence to Briggs & Stratton 4-cycle, *Air-Cooled* engines—"preferred power" in all fields—for the latest and most advanced developments for every application requiring ⅔ to 6 H.P. Briggs & Stratton with its concentration of technical knowledge, modern plants, equipment, and skilled workers—builds gasoline engines which are more than equal to today's most exacting power and performance requirements. You can expect *and get* more value per dollar if the appliances, farm machines, or industrial equipment you buy, sell or make are powered by Briggs & Stratton.

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pay 5,690 ft., TD 5,750 ft., perf. 120 holes 5,690-5,710 ft., PT 40 bbl. per day condensate and 1,700,000 cu. ft. gas through a ½-in. choke, or estimated 32,500,000 cu. ft. gas per day on open flow, TP 2,200 lb., CP 2,200 lb.

SOUTHWEST TEXAS WILDCAT FAILURES

Bexar County: Harry S. Stahl 1 R. Gastring, in M. Montoya Sur. 21, 9½ mi. SE of San Antonio, dry in Edwards lime, TD 1,720 ft.

Brooks County: Sun 3-B Mary M. Lasater, GB&CNG Survey 331, 6½ mi. SE of Falfurrias, dry, TD 4,899 ft.

Guadalupe County: United North & South Dev. Co. 1 Mrs. Cora Mackey, in James Hodges Sur. 66, 3 mi. E of Darst Creek field, top of Del Rio 2,815 ft., dry, TD 2,820 ft.

Live Oak County: Altex Well Servicing Co. 1 Schmid Heirs, in Sam Owen Sur. 132, 12 mi. NE of Three Rivers, dry, TD 1,736 ft.

H. E. Dirks et al 1 Frank E. Bliss, H&GN Sur. 1, 3 mi. SW of Cadiz, dry, TD 4,255 ft.

San Patricio County: Sullivan & Garnett 1 D. Zwieg, Block 1, Sec. 53, Sixth Addn. Taft Farm Lds., 86 mi. N of Gregory, dry, TD 5,940 ft.

Starr County: Balridge & King 1-A Yturria Ld. & Livestock Co. et al, Porcion 100, 1½ mi. NW of Sullivan City, dry, TD 5,503 ft.

Webb County: Edwin B. Cox and Jack Hamon 1 Clyde C. Marshall, SM&S Sur. 334, Abst. 1953, 5 mi. NE of Oilton, dry, TD 2,620 ft.

APPALACHIAN FIELD

Deepened Gas Well Results in Big Flow

PITTSBURGH.—In Elk district, Kanawha County, West Virginia, and in the new extension to the Elk-Poca Oriskany gas field, Columbian Carbon Co. completed 869 W. S. Jarrett, a former shallow well drilled deeper, in the Oriskany sand as a gas well gaging 9,303,000 cu. ft. natural. First gas appeared at 5,146 ft., total depth 5,153 ft. United Fuel Gas Co. 5,671 C. L. Myers drilled through the Oriskany sand at 5,248-80 ft. and after shhot at 5,248 to 5,312 ft., was good for only 179,000 cu. ft. of gas, total depth 5,319 ft.

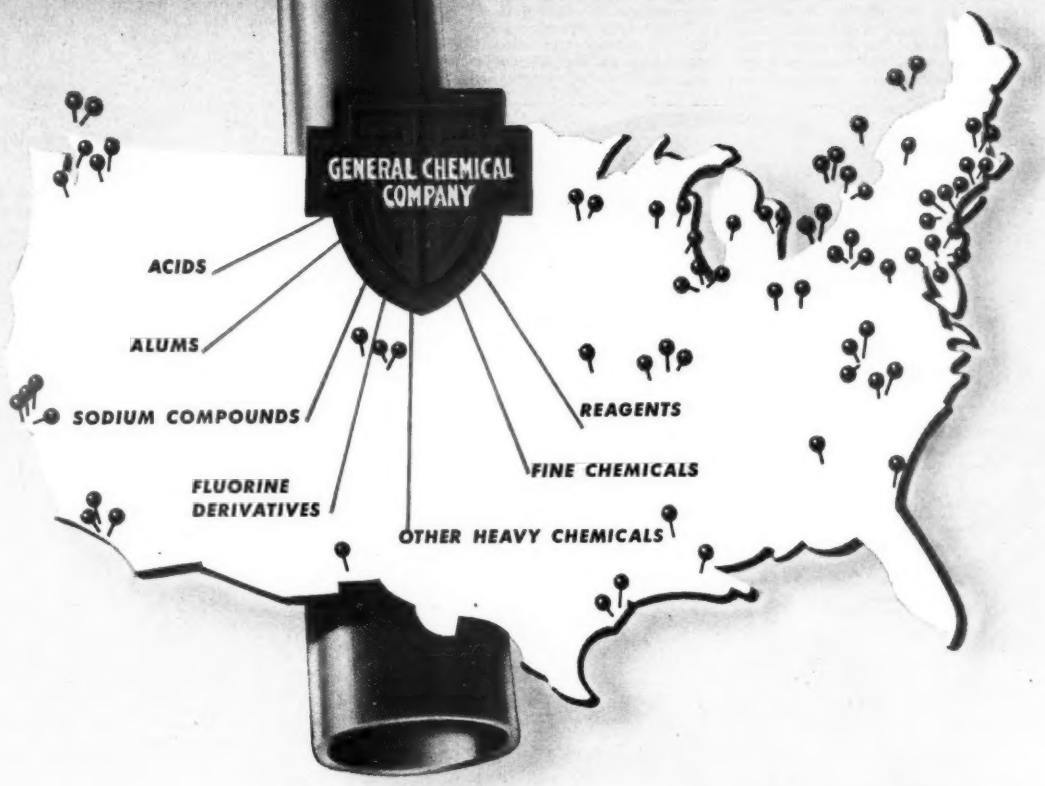
In Logan district, Logan County, West Virginia Gas Corp. completed 31 Dingess Run Coal Co. in the Berea for 1,138,000 cu. ft. gas, total depth 3,204 ft.

During the week, 21 new locations were listed in Crook and Scott districts, Boone County; Center and Sherman districts, Calhoun County; Falls district, Fayette County; Ravenswood and Ripley districts, Jackson County; Duval, Jefferson and Laurel Hill districts, Lincoln County; Clay and Murphy districts, Ritchie County; Buckhannon district, Upshur County; Union district, Wayne County; Union district, Wood County.

In southwest Pennsylvania, new locations totaled seven in Jefferson Township, Greene County; North Strabane Township, Washington County; Cowanshannock, South Bend and Kiskiminitas townships, Armstrong County; Limestone Township Clarion County.

In Fairfield Township, Westmoreland County, the important Oriskany wildcat of Peoples Natural Gas Co. on Camilla Giffin farm is drilling through the Onondaga chert at 7,178 ft. of 105 ft. in that member and should reach the sand during the week. So far, there have been no gas shows in the chert as found in South Union and Georges townships, Fayette County, on Chestnut Ridge.

Supply Line for American Industry...



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In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.
In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

TEXAS GULF COAST

Two New Pays Discovered In Sugar Valley Field

HOUSTON.—In the north extension area of Sugar Valley field in Matagorda County, two new sands have been opened by Superior Oil Co. of California and John H. Blaffer 1 Sadie E. Thomasson. Oil production is through the tubing from sandy formation topped at 9,082 ft. and through perforations from 9,083-86 ft. gaging 423 bbl. of 43-gravity oil daily with 1,350 lb. flowing pressure and 193,000 cu. ft. of gas. From the casing, the well produced 71 bbl. of 55-gravity condensate daily with 3,720,000 cu. ft. of gas with 3,070 lb. pressure from sand at 8,761-86 ft. and through perforations from 8,762-72 ft. The Van Vleck sand was found from 7,900-16 ft. Present sands producing in the field are at 9,754-59 ft. in the Peterson discovery and from 8,274-76 ft. in the 1 Culbertson, the latter being an oil well, and the discovery being gas and condensate.

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From your smallest to your largest well, there is a Thompson Shale Separator and Sample Machine to meet your most critical mud cleaning requirements. Saves You Money . . . by removing destructive shale and abrasives from drilling mud, thus reducing wear and tear on costly drilling equipment. Sample Machine attachment provides accurate foot by foot samples of cuttings. We can deliver Now! Order through your supply dealer or direct from the factory.

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the new pays while the dry wildcat is in Harris County.

UPPER GULF COAST SUCCESSFUL WILDCATS

Harris County: New gas-condensate pay, Tomball field—Humble 10 Edward F. Milo et al, C. N. Pillot Sur., Abst. 632, TD 15,542 ft., top sand 6,146 ft., perf. 78 holes 6,146-59 ft., PT 38 bbl. condensate per day through a ¼-in. choke, gas-oil ratio 81,500 to 1, TP 2,250 lb., 51° gravity, no water.

Matagorda County: Two new sands, Sugar Valley field—Superior Oil Co. and Jno. H. Blaffer 1 Sadie E. Thomasson, P. Burnett and A. S. Sojourner Sur., Abst. 13, dual completion, TD 10,100 ft., top sand 9,083 ft., perf. 19 holes 9,083-86 ft., "T" sand completion, PT 422 bbl. 24 hours through a 12/64-in. choke, gas-oil ratio 456 to 1, and 193,000 cu. ft. gas, TP 1,325 lb., 35? gravity, no water. "C" sand completion, top sand 8,761-86 ft., perf. 60 holes 8,762-72 ft., PT 3,720,000 cu. ft. gas daily and 71 bbl. of 55° gravity condensate, CP 3,070 lb., no water. (Van Vleck sand at 7,900-16 ft.)

UPPER GULF COAST WILDCAT FAILURE

Harris County: J. K. Dorrance 1 Alice Myer, Cypress area, in Wm. Francis Sur., Abst. 260, 4 mi. SW of Cypress, dry, TD 7,501 ft.

SOUTH LOUISIANA

Bayou La Fleur Discovery Flows 300 Bbl. on Test

NEW ORLEANS.—In the new Bayou La Fleur discovery area of Jefferson Parish, The California Co. 1 E. P. Brady et al, Lease 4, 66-16s-24e, flowed on commission potential 300 bbl. of 38-gravity oil daily hhrough a 9/64-in. choke with 1,400 lb. tubing pressure. Hole was drilled to total depth of 10,679 ft. before plugging back for a completion through 36 perforations at 9,366-72 ft. Gas-oil ratio is 343 to 1. The 2 E. P. Brady et al, approximately 1 mile southeast of the discovery well, drilled shale around 6,250 ft., while location for the 3 Brady et al is being prepared. It is located in 61-16s-24e.

Continental Oil Co. and Sohio Petroleum Co. 1 Cameron Parish School Board, wildcat test in the Johnson's Bayou area of Cameron Parish, 16-15s-14w, is preparing to make a test for production. The hole was drilled to 9,302 ft. where log was run and sidewall samples taken before setting 778 ft. of 5-in. liner on bottom. Pipe was perforated from 9,223-30 ft. for a squeeze job in three stages with 750 sacks of cement prior to making a set of perforations for a production test. Well is credited with sands showing gas in the 7,300-ft. and 9,000-ft. levels aside from showings in the 9,200-ft. level which is to be tested first.

Sohio Petroleum Co. 1 Matilda Gray, wildcat test on the Smith Ridge prospect of Cameron Parish, 12-15s-12w, continues to drill ahead with no showings reported. Last log was run at 11,700 ft., which had no shows indicated.

Sohio 1-B Claudius Fontenot et al, a west offset to the 1 Fontenot discovery well for the Bon Air field of Jefferson Davis Parish, 15-10s-6w, has been completed. This well is now shut in awaiting a potential test. On initial test it flowed 234 bbl. of pipe-line oil daily through a ⅛-in. choke with 1,360 lb. flowing pressure on the tubing. Pipe was perforated level with the discovery, from 9,694 to 9,704 ft. Total depth is 9,750 ft. and 5½-in. pipe is cemented at 9,736 ft. New location was immediately staked for 2-B Claudius Fontenot et al, which will be a west offset to the 1-B well, being center of the NE SE 16-10s-6w. Roads are being built to the location. Contract depth is 10,000 ft.

Eleven new locations were reported this week, with only one wildcat located in Point Coupee Parish. Of the 20 completions 7 are wildcats, 2 opened new sands and 1 oil pool was discovered. The new sands are in Iberia and and St. Mary Parishes, while the new oil pool is in Jefferson Parish. Assumption, Beauregard, Calcasieu, and St. Bernard Parishes each received one dry wildcat. Calcasieu Parish led with the greatest amount of activity, receiving three completions, while Assumption and Acadia parishes were next with two completions reported.

SOUTH LOUISIANA SUCCESSFUL WILDCATS

Iberia Parish: New oil pay, New Iberia field—Humble 2 Mayo Romero, 49-12s-7e, TD 9,844 ft., top sand 9,660 ft., perf. 36 holes 9,660-65 ft., PT 65 bbl. per day through 7/64-in. choke, gas-oil ratio 9,739 to 1, TP 2,880 lb., gravity 34°, no water.

Jefferson Parish: New oil pool, Bayou La Fleur—The California Co. 1 E. P. Brady et al, 66-16s-24e, TD 10,679 ft., top sand 9,363 ft., perf. 36 holes 9,366-72 ft., PT 300 bbl. per day through a 9/64-in. choke, gas-oil ratio 343 to 1, TP 1,400 lb., gravity 38°, 0.1 per cent water.

St. Mary Parish: New oil sand, Belle Isle field—Sun Oil 9-A Belle Isle Corp., 2-18s-10e, TD 10,405 ft., top sand 8,109 ft., perf. 100 holes 8,109-33 ft., PT 62 bbl. per day through a ⅛-in. choke, TP 250 lb., gas-oil ratio 413 to 1, gravity 34°, no water.

SOUTH LOUISIANA WILDCAT FAILURES

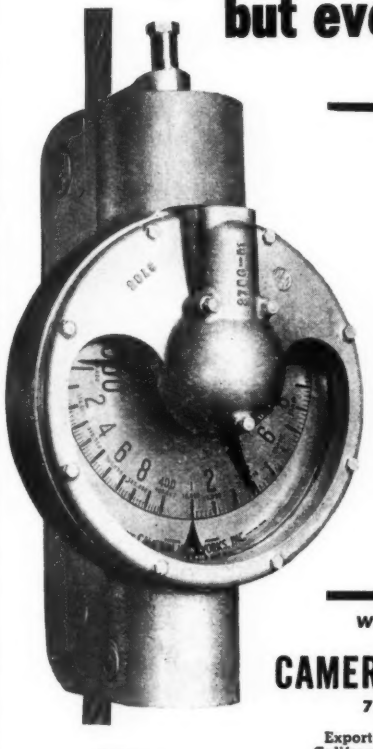
Assumption Parish: Union Oil Co. of Calif. 1 Norman-Breaux Lumber Co., on Grassy Lake Prospect, dry, TD 12,012 ft.

Beauregard Parish: Magnolia 2-D Lutcher-Moore Lbr. Co. in Mystic area, 6-6s-11w, dry, TD 8,404 ft.

Calcasieu Parish: Max Pray 2 Elizabeth Yust, 28-10s-12w, dry, TD 10,066 ft.

Rugged

but ever so sensitive!



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WEIGHT INDICATOR

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Matagorda County: Two new sands, Sugar Valley field—Superior Oil Co. and Jno. H. Blaffer 1 Sadie E. Thomasson, P. Burnett and A. S. Sojourner Sur., Abst. 13, dual completion, TD 10,100 ft., top sand 9,083 ft., perf. 19 holes 9,083-86 ft., "T" sand completion, PT 422 bbl. 24 hours through a 12/64-in. choke, gas-oil ratio 456 to 1, and 193,000 cu. ft. gas, TP 1,325 lb., 35? gravity, no water. "C" sand completion, top sand 8,761-86 ft., perf. 60 holes 8,762-72 ft., PT 3,720,000 cu. ft. gas daily and 71 bbl. of 55° gravity condensate, CP 3,070 lb., no water. (Van Vleck sand at 7,900-16 ft.)

UPPER GULF COAST WILDCAT FAILURE

Harris County: J. K. Dorrance 1 Alice Myer, Cypress area, in Wm. Francis Sur., Abst. 260, 4 mi. SW of Cypress, dry, TD 7,501 ft.

SOUTH LOUISIANA

Bayou La Fleur Discovery Flows 300 Bbl. on Test

NEW ORLEANS.—In the new Bayou La Fleur discovery area of Jefferson Parish, The California Co. 1 E. P. Brady et al, Lease 4, 66-16s-24e, flowed on commission potential 300 bbl. of 38-gravity oil daily hhrough a 9/64-in. choke with 1,400 lb. tubing pressure. Hole was drilled to total depth of 10,679 ft. before plugging back for a completion through 36 perforations at 9,366-72 ft. Gas-oil ratio is 343 to 1. The 2 E. P. Brady et al, approximately 1 mile southeast of the discovery well, drilled shale around 6,250 ft., while location for the 3 Brady et al is being prepared. It is located in 61-16s-24e.

Continental Oil Co. and Sohio Petroleum Co. 1 Cameron Parish School Board, wildcat test in the Johnson's Bayou area of Cameron Parish, 16-15s-14w, is preparing to make a test for production. The hole was drilled to 9,302 ft. where log was run and sidewall samples taken before setting 778 ft. of 5-in. liner on bottom. Pipe was perforated from 9,223-30 ft. for a squeeze job in three stages with 750 sacks of cement prior to making a set of perforations for a production test. Well is credited with sands showing gas in the 7,300-ft. and 9,000-ft. levels aside from showings in the 9,200-ft. level which is to be tested first.

Sohio Petroleum Co. 1 Matilda Gray, wildcat test on the Smith Ridge prospect of Cameron Parish, 12-15s-12w, continues to drill ahead with no showings reported. Last log was run at 11,700 ft., which had no shows indicated.

Sohio 1-B Claudius Fontenot et al, a west offset to the 1 Fontenot discovery well for the Bon Air field of Jefferson Davis Parish, 15-10s-6w, has been completed. This well is now shut in awaiting a potential test. On initial test it flowed 234 bbl. of pipe-line oil daily through a ⅛-in. choke with 1,360 lb. flowing pressure on the tubing. Pipe was perforated level with the discovery, from 9,694 to 9,704 ft. Total depth is 9,750 ft. and 5½-in. pipe is cemented at 9,736 ft. New location was immediately staked for 2-B Claudius Fontenot et al, which will be a west offset to the 1-B well, being center of the NE SE 16-10s-6w. Roads are being built to the location. Contract depth is 10,000 ft.

Eleven new locations were reported this week, with only one wildcat located in Point Coupee Parish. Of the 20 completions 7 are wildcats, 2 opened new sands and 1 oil pool was discovered. The new sands are in Iberia and and St. Mary Parishes, while the new oil pool is in Jefferson Parish. Assumption, Beauregard, Calcasieu, and St. Bernard Parishes each received one dry wildcat. Calcasieu Parish led with the greatest amount of activity, receiving three completions, while Assumption and Acadia parishes were next with two completions reported.

SOUTH LOUISIANA SUCCESSFUL WILDCATS

Iberia Parish: New oil pay, New Iberia field—Humble 2 Mayo Romero, 49-12s-7e, TD 9,844 ft., top sand 9,660 ft., perf. 36 holes 9,660-65 ft., PT 65 bbl. per day through 7/64-in. choke, gas-oil ratio 9,739 to 1, TP 2,880 lb., gravity 34°, no water.

Jefferson Parish: New oil pool, Bayou La Fleur—The California Co. 1 E. P. Brady et al, 66-16s-24e, TD 10,679 ft., top sand 9,363 ft., perf. 36 holes 9,366-72 ft., PT 300 bbl. per day through a 9/64-in. choke, gas-oil ratio 343 to 1, TP 1,400 lb., gravity 38°, 0.1 per cent water.

St. Mary Parish: New oil sand, Belle Isle field—Sun Oil 9-A Belle Isle Corp., 2-18s-10e, TD 10,405 ft., top sand 8,109 ft., perf. 100 holes 8,109-33 ft., PT 62 bbl. per day through a ⅛-in. choke, TP 250 lb., gas-oil ratio 413 to 1, gravity 34°, no water.

SOUTH LOUISIANA WILDCAT FAILURES

Assumption Parish: Union Oil Co. of Calif. 1 Norman-Breaux Lumber Co., on Grassy Lake Prospect, dry, TD 12,012 ft.

Beauregard Parish: Magnolia 2-D Lutcher-Moore Lbr. Co. in Mystic area, 6-6s-11w, dry, TD 8,404 ft.

Calcasieu Parish: Max Pray 2 Elizabeth Yust, 28-10s-12w, dry, TD 10,066 ft.

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St. Bernard Parish: Texas Co. 1 State-Chandeleur Sound State Lease 335, in Chandeleur Sound area, dry, TD 9,890 ft.

MICHIGAN

Michigan Operations Hampered by Weather

SAGINAW. — Hampered by spring thaws and rains, Michigan oil-field activity is slight, only 7 completions developing in the past week while 13 new locations were set.

Further decline in state crude production reflected the lack of development, five more dry wildcat tests being listed with the week's completions while the only producer was a 150-bbl. well in the Coldwater field of Isabella County.

Daily production from 3,513 wells in February was down to 43,274 bbl., compared to 45,260 in January.

MICHIGAN WILDCAT FAILURES

Gratiot County, Arcadia Township: H. L. McEvoy-Lawrence Russel 1 Oscar Fisher, NE NW NE 25-11n-3w, dry in Dundee, TD 3,270 ft.

Elba Township: Charles W. Teater 1 Marie Paprstein, NW NE SE 31-9n-1w, dry in Dundee, TD 3,050 ft.

Ottawa County, Wright Township: Edward J. Bouwsma 1 John Host, NE NW NE 32-8n-13w, dry in Monroe, TD 2,512 ft.

Lake County, Vales Township: MacCallum & Craft, Tr., 1 State, NE NW SE 27-17n-12w, dry in Dundee, TD 3,444 ft.

Van Buren County, Geneva Township: Ford Oil Co. 1 Abe Goldsmith, S½ NE NE 10-1s-16w, dry in Traverse limestone, TD 1,132 ft.

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CALIFORNIA

Fresno Wildcat Plugged Back to Test Temblor

LOS ANGELES. — Standard Oil Co. of California's wildcat operation in Fresno County has been plugged back to 5,805 ft. for a test of the Temblor in Miocene with a fair chance of finding production. Three sands were cored in the Eocene at 7,460-85 ft., 7,680-93 ft. and 7,735-60 ft. but the recovery was only a small amount of gas with no oil present. This southeast outpost topped the Temblor at 5,410 ft., top of the Kreyenhagen at 6,353 ft. and top of the Cretaceous at 7,759 ft. On the basis of the showing of this test it is quite likely that Standard or some other operator will drill an Eocene test soon at a high point structurally.

The Eocene in the Cymric district of Kern County has also received attention during the current week with encouraging success. The extent of the Eocene in this area, however, remains to be determined as a result of additional drilling. As far as is definitely known, Superior's 77-22 Woody in Section 22-29s-21e, is the first well to produce from the Point of Rocks sand of Eocene age at Cymric, although the same company's 67-22 Woody may also have been drilled to the Eocene in February. Superior has not released any data on subsurace formations found in 67-22 Woody below the top of the Oceanic sand and this reluctance tends to indicate something important has been found below the Oceanic sand of Miocene age. Both wells showed large volumes of gas, in the neighborhood of 5,000,000 cu. ft., and subsea level depths of both appear somewhat comparable. Of outstanding importance is the fact that Eocene sand production has been developed, thus increasing the future expectancy of the field which to date has been characterized by a lack of uniformity, a varying lithology and sudden pinch outs of of sands over short distances. Superior's 77-22 Woody was completed flowing 250 bbl. of clean 45-gravity oil daily through a 12/64-in. bean from 5,340 ft. along with 4,500,000 cu. ft. of gas.

In Whatcom County in the State of Washington, Standard has reached a depth of 4,595 ft. in Ferndale Community test and is drilling ahead. In Oregon, Richfield has just passed 2,000 ft. in 1 Barber located outside of Portland in Multnomah County and Texas is making hole on the Cooper Mountain test at 7,544 ft. None has reported any showings to date but drilling will continue as long as geological conditions remain favorable. The present well of Texas Co. is the second wildcat that company has drilled in the Pacific Northwest. The area undergoing development is extensive and as exploration work progresses and more data are available, geologists may be able to centralize future work in the best favorable areas.

Standard completed an interesting gas well in the Rio Vista gas field this week, the bottom of the hole being 930 ft. south and 1,760 ft. west of the surface location. This well was 6-H State which was bottomed beneath the Sacramento River and on which the State of California receives a high rate of royalty. The Hamilton sand was found at 5,178 ft. vertical depth and 5,697 ft. deviated depth. Actual drilling was done by Rocky Mountain Drilling Co. New locations made this week were on about a par with completions recorded during the same period further indicating a stabilized condition in the rate of drilling. There has, however, been a reduction in wildcat exploration but prospecting work is expected to get started again in the late spring. Shell has plugged back its

East Dominguez test from 10,478 ft. to 8,100 ft. and has perforated the 7-in. casing at 7,683-7,804 ft. and 7,860-9,925 ft. The company has cored some very tight oil sand in this outpost and it is questionable whether the well can show sustained production. Permeability is very low, ranging about 10 millidarcys.

CALIFORNIA WILDCAT FAILURES

Kern County, Belridge: Wilshire 2 Lehman, 18-28s-20e, bottomed in gray sand, no showings, TD 987 ft.

Dyer Creek: Royalty Service Corp., 34-M-1 Dyer Creek, 34-26s-27e, bottomed in hard gray sand, Vedder sand of Miocene age, topped at 3,231 ft., was barren, TD 3,762 ft.

Jasmine: Utility Associates 4-A Quinn, 15-25s-27e, bottomed in oil-stained sand, claimed oil sand 2,852-2,900 ft., landed 7-in. casing 2,901 ft., gun perf. 2,870-2,900 ft., bailed mud, water and sand, no oil or gas, TD 2,901 ft.

Mount Poso: U. S. Drilling Co. 1 Bohen, 27-26s-28e, bottomed in basement schist, Vedder sand of Miocene age was barren gray sand, TD 1,726 ft.

Los Angeles County, Newhall-Castaic: Newhall Potrero Oil Co. 1 Ferguson, bottomed in barren gray sand, had some encouragement but on test well failed to product, TD 8,520 ft.

Orange County, Huntington Beach: F. E. Mosier 1 Newland, 12-6s-11w, bottomed in gray sand, no important showings, test originally started by Rothschild Oil Co., TD 3,154 ft.

San Luis Obispo. Shandon: Tutin & Twisselman 1 Shandon, 5-26s-15e, bottomed in barren gray sand, had minor showings in overlying shale but not productive, TD 5,505 ft.

Ventura County, Sespe: Associated Pipe & Engineering Co. 1 Sespe, 5-5n-19w, bottomed in Sespe gray sand, only minor showings logged, TD 2,606 ft.

Ojai: F. A. Delaney 1 Victory, 8-4n-21w, bottomed in gray sand, no important showings logged, TD 3,551 ft.

MISSISSIPPI

Cranfield Work-Over Shows For Good Condensate Well

JACKSON.—The California Co. 1 National Gasoline, 52-7n-1w, flowed 314 bbl. of 52.4° gravity condensate on a 24-hour test during the process of being reworked as a gas-injection well in the Cranfield field. Perforations were made at 10,164-90 ft. and 10,224-80 ft. and the hole acidized after dual packers were set above the perforations. The well may be produced and reservoir conditions data secured until repressuring equipment is installed in the field.

Testing at 8,100 ft. is reported from the Danciger Oil & Refining Co. 1 George W. Armstrong, 660 ft. south of the north line and 660 ft. west at right angle to east line, 5-4n-2w, wildcat in Wilkinson County. A drill-stem test at 5,386-5,406 ft. received 90 ft. of mud and 1,110 ft. of salt water.

Mississippi reported six completions of which four wildcats were dry. The Cranfield well flowed 290 bbl. in 24 hours and the Eucutta field well pumped 88 bbl. in 24 hours.

MISSISSIPPI WILDCAT FAILURES

Copiah County: Stanolind Oil & Gas Co. 1 T. A. Huntington, NW SE 28-1n-1w, dry at 1,650 ft., Anhydrite 1,640 ft.

Carter Oil Co. 1 Reynolds C-133, 735 ft. south and 773 ft. east of northwest corner of 12-10n-5e, dry at 10,502 ft., Marine Tuscaloosa 9,732 ft.

Jefferson County: William Helis 1 Dockery-Carpenter, north 34° and 2,875 ft. west from southwest corner of 25-10n-2e, dry at 9,903 ft., Wilcox 3,590 ft.

Wayne County: R. L. Fisher 1 G.M & O.

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R.R. Co., SE NE 22-9n-8w, dry at 7,003 ft., sand 5,341-51 ft.

ALABAMA WILDCAT FAILURE

Walker County: J. H. Deason 1 DeBardelaben, SE NW 6-14s-5w, dry at 1,925 ft., Tuscumbia 1,925 ft.

ROCKY MOUNTAIN

Big Horn Basin Discovery Of Major Importance

DENVER.—A discovery of far more than ordinary importance is reported in Pure Oil Co. 1 Unit, NE NE NW 18-48n-92w, on the River Dome, in the southeastern part of the Big Horn Basin, Washakie County, Wyoming. On the basis of a drill-stem test through casing perforations opposite the Embar horizon, it is estimated good for at least 400 bbl. per day. The opening of a new pool in the Embar formation appears, however, secondary to several other unusual features accompanying the discovery.

Elk Basin, Frannie, Garland, Byron, Gebo, Little Buffalo Basin and a number of other structures, comprising some of the largest developed fields in Wyoming are located around the rim of Big Horn Basin. Lying basinward between the several rim fields is an area approximately 100 miles long and 50 miles wide which is practically virgin territory except for Badger Basin at the north end where the Frontier sands are found at 8,500 ft. The Pure Oil Co. well lies within the basin, and the discovery opens up a large territory for exploration.

Another unusual feature is that the oil found at River Dome is of an entirely different type from the black oils produced in the Embar in that general region. It is greenish-amber in color and preliminary tests indicates a gravity of 41.8°. The black oils in the surrounding fields run from 16° to 25° gravity.

A third feature out of the ordinary is that River Dome is the first in the Rocky Mountain area to be drilled through a Tertiary structure to structure beneath in lower beds. Not only was oil encountered in the lower Carboniferous beds, but in upper formations of the Cretaceous period. There is no surface geology, and structure was worked out by geophysical methods.

The top of the Embar formation was picked up at 9,978 ft., being hard and tight, but showing some saturation. Drilling continued to a total depth of 11,379 ft., stopping in the Big Horn lime, and finding water in that formation as well as in the Tensleep, Amsden and Madison, the tops in the order named being Tensleep, 10,245; Amsden, 10,420, Madison, 10,570 ft. The hole then was plugged back and the 7-in. was set at 10,241 ft., and then plugged back to 10,131 ft. The casing was perforated at 9,990-10,020 ft., and in a drill-stem test, open 13 minutes, the recovery was 2,800,000 cu. ft. of gas. It was then perforated at 10,020-55 ft., open 4½ hours, with a recovery of 4,000,000 cu. ft. of sour gas and an estimated 400 bbl. of oil. A separator and tanks are being set up preliminary to testing.

Previous to reaching the lower beds, the well had topped the Torchlight (First Frontier) sand at 7,138 ft., and a drill-stem test at 7,229-72 ft., open 8 minutes, showed 5,000,000 cu. ft. of gas and 47 ft. of 54° gravity oil through a 4½-in. drill pipe with a ¼-in. choke. The shut-in pressure was 2,800 lb., and bottom-hole pressure 3,800 lb. Coring then continued through the remaining Frontier sands, which showed gas and distillate, but no tests were made on account of the heavy pressure. The Frontier was then cased off with the 9⅝-in. at 7,596 ft. The top of the Muddy was picked up at 8,117 ft., and a drill-stem test at 8,250 ft. indicated 5,000,000 cu. ft. of gas and 200 bbl. per day of condensate. A second well was started to the north to test these upper horizons. This well, 1½ miles to the north, had 5,000,000 cu. ft. of gas and condensate in the Frontier at 7,500 ft. and is drilling at 7,675 ft. toward the lower Frontier, indicating a structure of considerable size.

New operations.—Eight new operations were reported, of which two are in Colorado, five in Wyoming, and one in Montana. The Colorado operations include one well for the California Co. in Rangely, and a wildcat in the Sullivan Park district, Pueblo County, by Continental Oil Co. The latter is a wildcat, Continental 1 State, NE NE SE 4-18s-67w, on the Sullivan Park structure. It is 14 miles west of same company's 1 Paige, recently abandoned at 6,929 ft., and 4 miles southeast of Colorado Petroleum, Inc. 1 Hart, which is testing a show of free oil at 3,100 ft., in what is believed to be the Harding sand. The Wyoming locations include one each in Little Buffalo Basin, Big Muddy, Lost Soldier, Garland and Frannie fields. The Big Muddy well is a test at the north end of the field in Smith, Anderson & Dyer No. 1, SW SW NW 3-33n-76w, a farmout from Continental Oil Co. The Montana location is for a shallow well in the Cedar Creek gas field.

Completions.—Eight wells were completed, of which five were oil wells with initial production of 1,081 bbl., one was a gas well and two were dry holes The only completion in Colorado was in the Rangely field for 463 bbl. in 19 hours. The Wyoming completion was a wildcat which was dry. Montana had three oil wells in the Cat Creek field for 534 bbl., and one small gas well at Cedar Creek. The New Mexico completion was a dry hole in Bernalillo County.

WYOMING WILDCAT FAILURE

Baggs, Carbon County: Texas Co. 1 Baggs Unit, NE SE SE 35-13n-92w, TD 7,450 ft. in Mesa Verde, top Mesa Verde 7,150

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ft., tested all sands through Wasatch formation, no important shows, plugged.

NORTHWEST NEW MEXICO WILDCAT FAILURE

Pajarilo, Bernalillo County: Norins Realty Co., Inc. 2 Pajarita, C NW NE 22-9n-1e, TD 2,770 ft., plugged back to 1,500 ft. and completed as a water well.

PERMIAN BASIN

Devonian Proven Productive in New Pool

MIDLAND.—Devonian production for the Goldsmith field in northwestern Ector County was indicated at Stanolind Oil & Gas Co. 1 Grisham-Hunter Corp. on a 54-minute drill-stem test from 6,869 to 7,944 ft. There was gas to the surface in 4 minutes, oil in 51 minutes and it flowed oil for 3 minutes at a rate estimated between 15 to 20 bbl. hourly. Gas volume was estimated at 50,000 cu. ft. in 24 hours. Devonian was topped at 7,917 ft. Elevation is 3,309 ft. The test is in Section 34, Block 43, T-2-S, T&P Survey. Stanolind began deepening the test late in January. The well was abandoned by Grisham-Hunter Corp. in 1944 at 6,494 ft. as its 1-B R. B. Cowden. The test is on the northwest edge of the field where production is from the San Andres at around 4,300 ft. The nearest Devonian production is in the TXL field about 8 miles to the south.

Phillips Petroleum Co. 1 Eidson, Section 25, Block B-15, PSL Survey, wildcat west of the north end of the Penwell pool of southwestern Ector County, ran a 70-minute drill-stem test of the Waddell section of the Simpson from 8,636 to 8,755 ft. and recovered 314 ft. of very slightly oil and gas-cutting drilling mud. It was drilling below 8,793 ft. in shale with streaks of sand. Cities Service Oil Co. 1 Parker, Section 20, Block 44, T-2-S, T&P Survey, wildcat west of the Harper pool of western Ector County, took a 2-hour drill-stem test from 10,326-510 ft. in the Devonian. Recovery was 1,085-ft. water blanket and 105 ft. of drilling mud with no shows. The test has been shut down for orders pending decision to deepen or to attempt completion in upper zones.

Humble Oil & Refining Co. 1 Kent, Section 45, Block 5, H&GN Survey, indicated Ellenburger discovery in southeastern Kent County, 2 miles northwest of Polar, recovered 5 ft. of drilling mud with no shows of oil or gas on a drill-stem test to 7,851 ft. The test apparently had no saturation below 7,799 ft. where it recovered 2,396 ft. of clean, 36.3-gravity oil on a 1-hour drill-stem test. Operator was coring ahead. Ellenburger was topped at 7,773 ft. Argo Oil Corp. 1 Roberts, Section 294, Block 13, H&GN Survey, 13 miles southeast of Balmorhea, southeastern Reeves County wildcat, recovered 1,980-ft. water blanket and 60 ft. of distillate on a 4½-hour drill-stem test from 10,018-047 ft. It was coring below 10,057 ft. in sand and lime.

Stanolind 1 Mack Taylor, Section 8, Block B-2, Public School Land Survey, 1½ miles east of the Keystone-Ellenburger field, Winkler County, was drilled to 10,280 ft. It was plugged back to 8,730 ft. The casing was perforated from 8,040-8,135 ft. in the Devonian and tested natural after loading with 193 bbl. of oil. In 13 hours it flowed 152 bbl. and in the next 11 hours flowed another 152 bbl. It made 225 bbl. of oil on a later 24-hour flowing test.

TXL field, Ector County, reported three completions this week, Iataan E. Howard field, Howard County, Howard-Glasscock field, Howard and Glasscock counties; McElroy field, Crane County, and Slaughter field, Hockley and Cochran counties, each had two. Welch field, Dawson County, had three locations; Wheeler-Ellenburger field, Winkler County, and TXL field each two.

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TXL field has 37 drilling wells; Keystone-Ellenburger field, Winkler County, 33; Fullerton field, Andrews County, 24; Block 31 field, Crane County, 21; Welch field, 13, and Todd Deep field, Crockett County, 9.

WEST TEXAS SUCCESSFUL WILDCATS

Andrews County: New oil pay—Humble 2 Parker, Sec. 23, Blk. A-41, PSL Sur., Martin pool, elev. 3,310 ft., flowed natural 1,594 bbl. day through ½-in. choke, perf. 8,850-65 ft. Ellenburger, gravity 42.3°, gas-oil ratio 128 to 1, TD 8,880 ft.

Hockley County: Extension to old oil pool—Stanolind 1 Veretto, Lab. 7, Lge. 72, Val Verde CSL, 2¾ mi. SE discovery well Levelland pool, elev. 3,562 ft., IP 343 bbl. day through 1½-in. choke on 2-in. tubing, perf. 4,760-4,853 ft. San Andres, gravity 30.6°, TD 4,889 ft.

Winkler County: New oil pay—Texas Pacific Coal & Oil 1 Brown Altman Acct. No. 4, Sec. 25, Blk. B-5, PSL Sur., Emperor Deep pool, elev. 2,807 ft., IP 265 bbl. day through 5/64-in. choke on 2-in. tubing, perf. 4,765-4,810 ft. Holt, gravity 40.1°, gas-oil ratio 800 to 1, TD 6,255 ft.

WEST TEXAS WILDCAT FAILURES

Concho County: Eltex, Ltd., 1 Pauline Cox Roberts, Sec. 147, Blk. 72, T&NO Sur., 7½ mi. NE Eden, elev. 1,972 ft., dry in Ellenburger, TD 4,060 ft.

Crane County: S. W. Richardson 1 S. T. Dawson, Sec. 2, Blk. 139, A. L. Brigance Sur., 2 mi. NW McCamey, elev. 2,412 ft., Simpson (1st) 6,930 ft., Ellenburger 7,330 ft., Simpson (2nd) 7,530 ft., dry, TD 8,170 ft.

Fisher County: Frank Buttram et al 1 S. F. Mason, Sec. 2, Blk. E, Sallie English Sur., 5 mi. SE Sylvester, Flippen 3,135 ft., dry, TD 3,300 ft.

Lubbock County: R. F. Windfohr and Milhoan Prod. 1 Mrs. J. T. Krueger, Sec. Lubbock, elev. 3,248 ft., San Angelo 5,390 ft., Clear Fork 5,525 ft., dry, TD 6,535 ft.

Reeves County: Continental 1 H. T. Collier, Sec. 180, Blk. 1, H&TC Sur., 19 mi. SE Saragosa, elev. 2,884 ft., Delaware 5,253 ft., TD 5,377 ft.

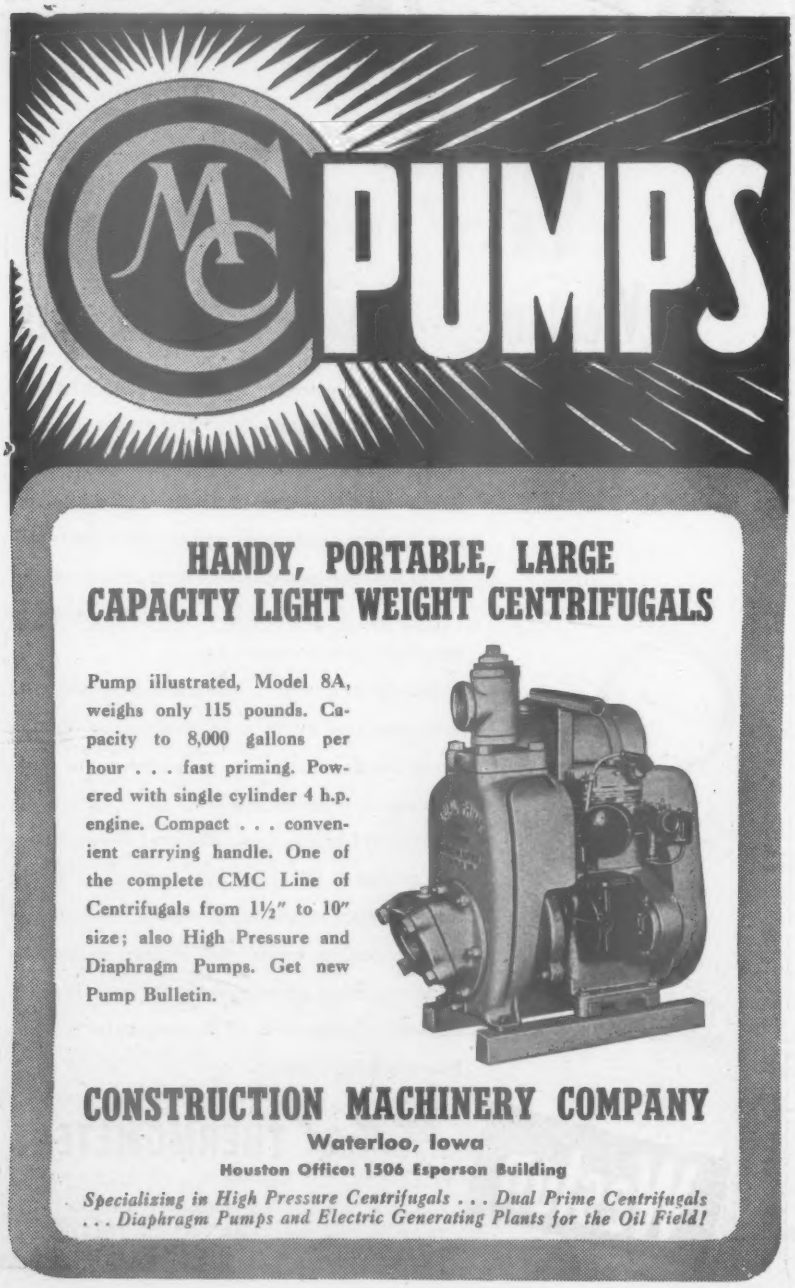
SOUTHEASTERN NEW MEXICO

HOBBS.—Humble Oil & Refining Co. 1-B Hardison, 34-21s-37e, Lea County, indicated opener of a new producing area from the Yeso (Holt) zone of the Clear Fork for southeastern New Mexico, swabbed to the plugged-back of 6,560 ft. and reported a small show of oil and gas. After being treated with 2,000 gal. of acid, the well kicked off without swabbing after acid load had been lifted. It flowed into pits for 6 hours and into tanks for 3 hours. It made 21.84 bbl. of fluid, 2.8 per cent acid sludge, in the last hour of the three. It was continuing to test.

Square Lake field, Eddy County, and Caprock field, Lea and Chaves counties, each had two completions. Grayburg-Jackson field, Eddy County, had two locations and West Lovington field, Lea County, had one. Grayburg-Jackson field had seven drilling wells; Penrose-Skelly field, Lea County, six; Empire field, Eddy County, and Paddock field, Lea County, each five, and Drinkard field, Lea County, four.

SOUTHEASTERN NEW MEXICO WILDCAT FAILURE

Lea County: Culbertson & Irwin, Inc. 1-D State, 4-21s-34e, 3 mi. NW West Eunice field, elev. 3,711 ft., Yates 3,761 ft., dry, in Seven Rivers, TD 4,005 ft.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OKLAHOMA

Garvin County Prospect May Drill to Wilcox

R. H. DEARING & SONS 1 McBride, NE NW NW 30-4n-2w, a closely watched Garvin County wildcat northwest of Antioch, is shut down at a depth of 6,647 ft. while operators consider drilling ahead to the Wilcox. At present the well is about 13 ft. in the Sylvan shale.

The 1 McBride recovered 3,000,000 to 5,000,000 cu. ft. of gas and a spray of oil on a 34-minute test of the basal Pennsylvanian with packer set at 6,573 ft. The oil tested 44° gravity, and bottom hole pressure was 2,700 lb. After coring ahead, a second drill-stem test was made at 6,574-99 ft. and the well flowed another 3,000,000 to 5,000,000 cu. ft. of wet gas and recovered 120 ft. of oil. The well was then drilled ahead and the Hunton was picked up at 6,611 ft. The Bois d'Arc was missing but the Chimney Hill zone was topped at 6,615 ft.

A 90-minute drill-stem test with packer set at 6,612 ft., about 1 ft. in the Hunton lime, recovered 120 ft. of gas cut mud. An electric log was then run and the test shut down for orders. The 5½-in. casing is on location but has not been run.

OKLAHOMA WILDCAT FAILURES

Cotton County C. W. Smith and W-L-U Drilling Co. 1 McAlister, SW SW SW 22-2s-10w, dry at 2,240 ft.

Garvin County: Cities Service and Stanolind 1 Hoffman "B," SW SE NW 21-3n-1w, dry at 5,300 ft., sand 5,096-101 ft.

Lincoln County: Wofford, Nicholson & Rose Co. 1 S. Steger, SE SE SE 3-15n-5e, dry at 3,550 ft., Prue 3,352 ft.

Jordon Petroleum Co. 1 Dean, NW NW NE 7-15n-1e, dry at 5,785 ft., Wilcox 5,770 ft.

Wilcox et al 1 Seifert, SE SE NW 4-14n-6e, dry at 3,257 ft., Peru 3,247 ft.

McIntosh County: L. A. Chudacoff 1 Tabor, NE SW SE 11-11n-16e, dry at 3,209 ft., Wilcox 3,185 ft.

Okfuskee County: Davon 1 Replogle, SE SE SW 17-13n-8e, dry at 4,251 ft., Cromwell 3,616 ft.

Seminole County: Glove 1-A Norwell, NE SW SW 20-7n-7e, dry at 3,332 ft., Caney 3,312 ft.

Tillman County: T. H. McCasland 1 Mounts, SE SE NE 18-2s-16w, dry at 3,704 ft., limestone 3,591-635 ft.

KANSAS

Southern Pratt County Has Successful Wildcat

IN a 7-hour test, the Bridgeport Oil Co. 1 Stoops, SE SE SW 7-29-12w, a wildcat in south central Pratt County, flowed 62 bbl. of oil and 2,330,000 cu. ft. of gas from perforations in the Viola at 4,446-52 ft. The well, originally completed as a dry hole in 1943, was reopened by Bridgeport after reexamining samples. Pipe was set at 4,582 ft. before making perforations in the Viola. The Simpson was topped at 4,537 ft., and Arbuckle at 4,680 ft. Total depth was 4,731 ft. The wildcat is 4½ miles southwest of the Chitwood pool.

The Arnold pool in Ness County has added another well with the Sohio Petroleum Co. 3 Drake, NW SW NW 26-16-25w, producing 9 bbl. an hour from the Fort Scott limestone at 4,445-52 ft. After drilling to a total depth of 4,519 ft., the hole was plugged back, perforated at 4,445-52 ft., and acidized.

Kansas had 28 completions of which 5 wildcats were dry. Field wells totaled 23 with 16 oil, 2 gas and 5 dry.

KANSAS WILDCAT FAILURES

Butler County: O. J. Connell 1 Eckel, SE SE NE 1-26-5e, dry at 2,750 ft., Mississippi lime 2,718 ft.

Ness County: Jones & Shelburne et al 1 Bryan Eval, SW SW NW 7-16-25w, dry at 4,523 ft., dolomite 4,508 ft.

Rooks County: Goodpasture and Vernon Oil & Gas Co. 1 J. Casey, SW SW SE 16-9-19w, dry at 3,583 ft., Arbuckle 3,549 ft.

Trego County: Continental Oil Co. 1 Joswokoske, SE SE NW 2-15-21w, dry at 3,250 ft.

Woodson County: Donovan Engineering Co. 1 Eads, NW NE NE 10-25-15e, dry at 1,920 ft., Arbuckle 1,817 ft.

LA.-ARK.

Test in Rodessa Recovers Salt Water

SHREVEPORT.—A drill-stem test in the Rodessa at the Union Producing Co. 1 Louisiana Long Leaf Lumber, SW SW 29-8n-11w, wildcat in Sabine Parish, recovered 1,700 ft. of salt water in 15 minutes. Drilling is being continued below 6,100 ft. in shale, sand and lime.

North Louisiana had 14 completions. Two wildcats in Richland and in Bossier Parish were dry. Big Creek added three oil producers and Lake St. John and East Haynesville each completed two. Caddo had one oil. There were four gas wells completed with one each in Vixen, Lisbon, Lucky and Monroe.

Arkansas reported three completions. The wildcat in Lafayette County was dry. Wesson field added one oil producer and Smackover field had one completed as an oil well.

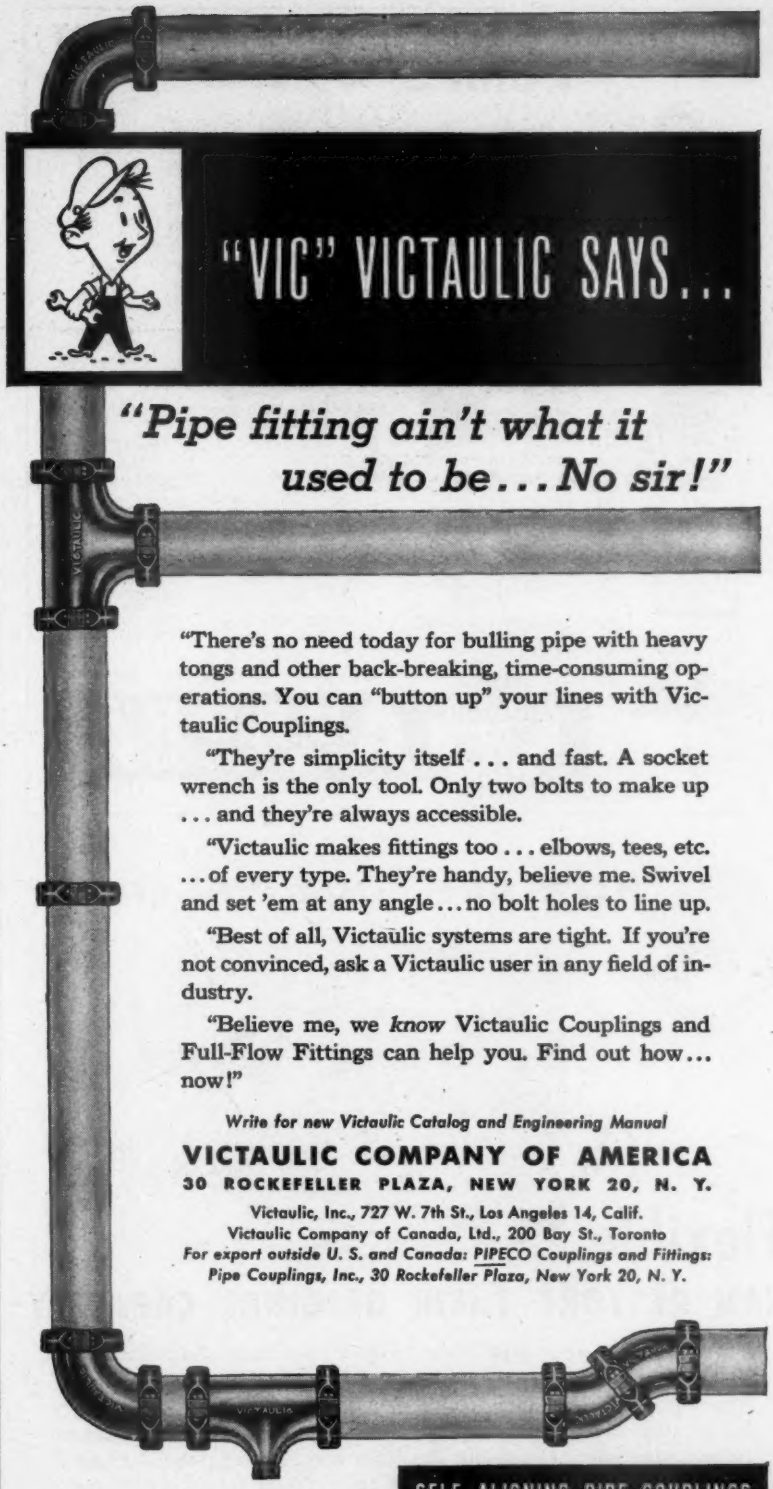
ARKANSAS WILDCAT FAILURE

Lafayette County: Texas 1 C. W. Persons, NW SE 29-16s-25w, dry at 4,203 ft.

NORTH LOUISIANA WILDCAT FAILURES

Bossier Parish: H. C. Owens et al 1 Skidmore, NE SE 1-16n-11w, dry at 5,366 ft.

Richland Parish: H. G. Lewis et al 1 R. R. Rhymes, 660 ft. north and 662 ft. east of southwest corner of NW SE 8-15n-5e, dry at 4,218 ft.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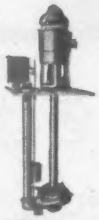

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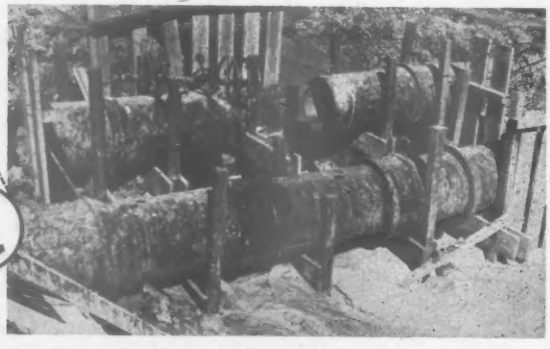

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CANADIAN FIELDS

Gas-Condensate Production Reported at Brazeau

CHATHAM.—An important development is reported on the Brazeau structure in the Central Alberta foothills where Home Brazeau Syndicate 1, LSD 5, 17-43-17w5, has developed substantial wet gas production with indications of light green oil in the upper lime. The well, a joint test sponsored by a group of Alberta companies, got the first Madison contact at 9,498 ft., faulted back at 9,597 ft., reentered the Madison at 11,351 ft. and again faulted at 11,599 ft., discontinuing drilling at 11,689 ft. The lower section was cemented off and the upper lime acidized with 1,000 gal. Closed in, the pressure reached 3,100 lb., a high for Alberta fields, and on opening after several hours a gas flow of 2,500,000 cu. ft. was recorded. The oil is apparently condensate from the gas, which has not yet been tested for content. Further tests are being made after additional acidizing. Indications are that the test is an edge well, and a second may be drilled west of the discovery.

Turner Valley.—In the Turner Valley north extension, Continental 1, LSD 8, 4-21-3w5, offset to Major 9 and Foothills 15 producers, finished with Madison at 7,905-8,745 ft. and is testing three porous horizons, with indications of a large producer. This is the first of a series of offset wells, with 12 others located and acreage reserved for 16 additional tests.

Kinsella.—In the Kinsella field, east of Edmonton, Imperial-Kinsella 9, LSD 6, 16-46-9w4, has finished at 2,080 ft. as a large gasser, though figures are not given on initial open flow. Imperial-Kinsella 1 is starting in 28-17-8w4. In the western end of the field, Northwest Utilities 18 has location in LSD 10, 20-48-11w4, and NW 19 in LSD 6, 32-48-11w4. Imperial drilling in Kinsella is planned to furnish gas for a synthetic gasoline plant.

OHIO, KENTUCKY

Gas Production Found in Salt Creek Township

COLUMBUS.—Two Clinton sand gas wells were found while drilling for Medina oil production in the south part of Salt Creek Township, Muskingum County. Salt Creek Development Co. 1 U. S. A.-Cline, Section 34, gaged 1,629,000 cu. ft. Clinton was topped at 4,368 ft. and the main pay at 4,400 ft. Industrial Gas 21 U. S. A., Section 34, found the top of the Clinton at 4,383 ft. and 1,000,000 cu. ft. at 4,399 ft. In the same Township, Wasson 1 Mary Murphy, Section 28, made 30 bbl. from the Medina, logged at 4,139-46 ft.

The North Canton gas pool continues to expand with a mile extension by Obermiller et al on J. G. Laughlin, Section 34, Plain Township, Stark County. Clinton from 4,565 to 4,633 ft. made 2,304,000 cu. ft. natural and 3,959,000 cu. ft. when shut in after shot.

The Canton, Somerset, Salt Creek and Lorain areas continue as the most active areas of the state and combined, account for about one-half of the wells now drilling. Fifteen locations were reported this week with 5 in Lancaster, 4 in Cambridge and 3 in Brush Creek. Of the 25 completions, Ashland and Cambridge led with 6 each.

WESTERN KENTUCKY

OWENSBORO.—The Hitesville pool of Union County attracted considerable attention during the past week with the completion of Carter Oil Co. 1 George Nally,

25-P-21. This well was completed in three pay zones in the McClosky lime at 2,574-84 ft., 2,592-2,616 ft., and 2,672-74 ft., total depth 2,679 ft. Following an acid treatment of 8,000 gal. the 1 Nally flowed 1,608 bbl. of oil a day. It is the best recent completion in this field.

Material is being moved on location for Harry Ames et al 1 Ryan Oil Co. et al, 25-P-20, a 3,600-ft. Devonian test in the Uniontown area of Union County. The test is scheduled to start this week and will be the first deep test in the Uniontown area.

Three oil wells were completed in western Kentucky during the past week, all of which were field wells. Three new operations were announced, one in the Waverly North pool of Union County and two in the Dixie pool of Henderson County. The Dixie pool is leading in total number of active operations at the present time with six wells under way.

EASTERN KENTUCKY

ASHLAND.—Pike County topped the list in field workings in eastern Kentucky for the past week with a gas completion for open flow of nearly 2,000,000 cu. ft.

Kentucky-West Virginia Gas Co. completed well No. 5,615 on the Russell Pinson property, Pike County, total depth 2,160 ft., daily open flow 1,917,000 cu. ft. of gas in Big lime.

Inland Gas Corp. completed two wells, No. 284 on the J. H. Hammonds property, Magoffin County, and No. 289, W. A. Combs property, Knott County. Both wells were gas producers.

A. V. Hoenig completed well No. 2 on the W. F. Lewis property, Elliott County, as a dry hole at 940 ft.

Coleman Hunter completed well No. 3 on the J. W. Gillum Heirs' property, Rocky Branch, Elliott County, at 785 ft. for 2 bbl. of oil.

INDIANA

EVANSVILLE.—Exploration in Indiana was at a record low during the past week with only one wildcat test reported among the active drilling wells. This well, Continental Oil Co. 1-D Cooper Estate, SW SW SW 13-3s-14w, a Trenton test in the Griffin field, is shut down at present at a depth of 2,047 ft. due to high water from the Wabash River.

Only three completions were reported during the week, all of which were successful field completions. Four new operations were reported, two in Gibson County and one each in Spencer and Posey counties. Gibson County at present has 19 drilling wells and Posey County 18.

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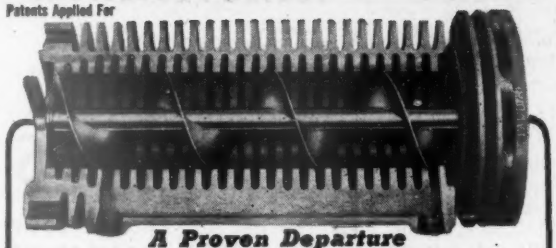

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Among the Drilling Contractors

Williams & Boling Drilling Co. will drill the Arthur E. Williams 2 Long, NW SE SE 15-9n-1w, in the Elba field, Gratiot County, Michigan.

Neal Emmons and William H. Martin of Bakersfield, Calif., have recently organized the firm of **Emmons & Martin** to engage in contract drilling of oil and gas wells.

George Wrather Drilling Co. will drill the first deep Devonian test in the Uniontown area, Union County, Kentucky, for Harry Ames et al. The well is the 1 Ryan Oil Co. et al, 25-P-20.

Fisher-McCall Oil & Gas, Inc., will drill the W. D. Gannett 1 Fred Meyers, NE NE NE 31-1s-12w, a wildcat in Kalamazoo County, Michigan.

Hayes Drilling Co. is moving in materials on the Central Pipe Line 1 Rose, SW NE SE 30-1n-14w, Edwards County, Illinois.

Wayne Drilling Co. has the contract to drill the William P. Muller 1-A Frank Ruppel, 990 ft. from the south line and 990 ft. from the west line of SW NE 1-1n-11w, in Knox County, Indiana.

Godfrey Drilling Co. has the contract to drill the 1 Earl F. Middlemas, NW SW SE 35-3n-14w, a wildcat in Allegan County, Michigan, for Chester Anderson.

V. R. Bachelor Drilling Co. will drill the Fred J. Pfunder & Associates, Inc. 3 Martin Smith, 660 ft. from the south line and 150 ft. from the east line of SE SW 6-7s-7w, in Spencer County, Indiana.

Lupher Drilling Co. has been awarded the contract to drill two wells for the Sohio Petroleum Co. and one for Rex Oil & Gas Co. in Michigan. The Sohio wells are the "A"-1 Howard Lomis, N½ of SE SE 31-16n-6w, Coldwater pool, Isabella County, and the 1 H. B. LeBeck, NW NE SW 1-11n-7w, Douglass pool in Montcalm County. The third well is the Rex Oil & Gas 1 Otto Skalitzky and C. E. Weller, NW NW SE 8-14n-7w, Wheatland County.

Can-Tex Drilling Co. of Calgary has the contract for four wells to be drilled as joint tests by McColl-Fron-

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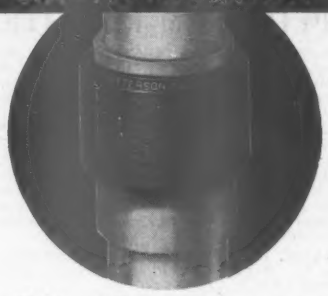

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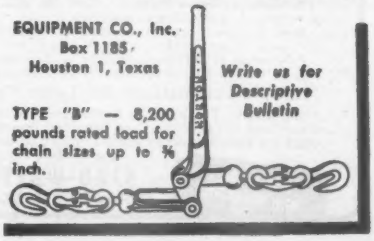

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tenac Oil Co. and Union Oil Co. near the Pinhorn Dome, in southern Alberta, just north of the Montana boundary. McColl-Union 11-B-6-2-8 has location in LSD 11, 6-2-8w4.

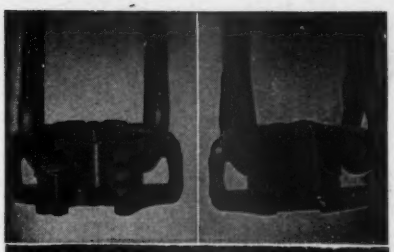
Alberta Diamond Drilling Co. of Calgary is making application to change its name to **Boyles Bros. Drilling (Alberta) Ltd.**

Drilling Contractors Hold Meeting in Tulsa

The Insurance and Safety Committee of The American Association of Oilwell Drilling Contractors held the seventh in a series of conferences April 2, in Tulsa. William Broadhurst, chairman of the committee, presided over the meeting. A field program to reduce accident and insurance costs was discussed and definite plans were made to extend the program in Oklahoma. The meeting was open to any individual interested in a safety program on drilling operations.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington 25, D. C. Notice is hereby given that sealed bids will be received until noon on Monday, April 15, 1946, for land described herein situated within the known geologic structure of the Moffat Oil Field, Colorado. This land is offered to qualified bidders of the highest cash amounts per acre as a bonus for the privilege of leasing the land under section 17 of the leasing act as amended by the Act of August 21, 1935 (49 Stat. 674, 30 U.S.C. sec. 226), in the following parcels: T. 4 N., R. 91 W. Parcel No. 1, sec. 9, lots 7 and 8, 69.50 acres. Parcel No. 2, sec. 11, lots 6, 7, 8, 9, 10, 15, 16, 187.89 acres. Parcel No. 3, sec. 15, lots 1 and 8, 73.78 acres. Parcel No. 4, sec. 15, lot 5, 38.91 acres. T. 5 N., R. 91 W., Parcel No. 5, sec. 27, lot 15, and lots 13, 16, 17, 18, 21 in Tract 53; sec. 34, lots 2, 4, 6, 9 in Tract 53, 160.19 acres. Parcel No. 6, sec. 28, lots 4, 5, 6, 7, 8, 165.53 acres. Parcel No. 7, sec. 29, lots 1, 2, 7, 8, 9, 14, 206.10 acres. Parcel No. 8, sec. 32, lots 5 and 6; sec. 33, lots 4, 5, 13, 14, 114.15 acres. Parcel No. 9, sec. 33, lots 1, 2, 3, 7, 167.81 acres. Parcel No. 10, sec. 34, lots 8, 10, 12, 85.99 acres. Parcel No. 11, sec. 34, lots 15, 16, 21, 22, 157.50 acres. Parcel No. 12, sec. 35, lots 3, 4, 6, 7, 8, 11, 12, 13, 14, 15, 16, 449.22 acres. Total 1,876.57 acres. Bids must be submitted on each parcel separately, but if two or more parcels are awarded the same bidder, they may be included in a single lease, provided the combined acreage does not exceed 640 acres. Each bidder must submit with the bid one-fifth of the amount bid in cash, or by certified check made payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease, required under 43 CFR 192.19. The envelopes should be plainly marked "Bid for Parcel No. .., Moffat Oil Field. Not to be opened before noon, Monday, April 15, 1946." No bids received after the hour fixed herein for the opening of bids will be considered. The remainder of the bonus and the annual rental at the rate of $1 per acre must be paid and a $5,000 corporate surety bond must be furnished by a successful bidder prior to the issuance of a lease. The deposits of the other bidders will be returned upon acceptance of the successful bids by the Secretary of the Interior. The successful bidder will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin, and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.



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PERSONALS

J. H. Graham Directs Unitization for Continental Oil

THE task of directing and coordinating unitization in producing fields in all regions will fall to J. H. Graham, new assistant manager of production and drilling east of the Rocky Mountains for Continental Oil Co.

Graham, whose appointment was announced by W. C. MacMillan, company vice president, will also work with Continental's natural-gas and natural gasoline division to expand the company's market outlets. His headquarters will be in Houston.

A native of Butler, Pa., Graham received a B.S. degree from Allegheny College, Meadville, Pa. He joined Continental in October, 1945, as superintendent in charge of unitization in the company's southern region, land department, at Houston. Previously he was an independent operator in Texas and Oklahoma and served as district director of the natural gas and gasoline division of the Petroleum Administration for War in Houston.

H. S. Brown, president of Foster Wheeler Corp., has been elected chairman of the board to succeed his brother, the late J. J. Brown. **David McCulloch,** executive vice president, was chosen chairman of the executive committee by the directors to succeed H. S. Brown.

Dr. Robert E. Wilson, chairman of the board of Standard Oil Co. Indiana, and nine other officials of the company this week were visiting properties of Indiana affiliates in West Texas after spending several days in Tulsa. Dr. Wilson described the trip as a "get acquainted" tour. Others in the group were **A. W. Peake,** president; **F. O. Prior,** vice president in charge of production; **R. F. McConnell,** vice president in charge of sales; **B. F. Jones,** vice president and general counsel; **M. G. Paulus,** vice president in charge of manufacturing; **Bruce K. Brown,** vice president in charge of development; **H. E. Hanson,** general manager of sales; **L. C. Welch,** general manager of lubricating oil and sales and technical service; and **Harry F. Glair,** general manager of manufacturing.

Byron B. Loomis has been made personnel and public relations manager of Colonial Beacon Oil Co., following his return to the company after nearly 5 years' service in the Navy. Loomis, an Annapolis graduate who was called to duty on his reserve commission in 1941, joined the company in 1933 and formerly was sales engineer for the Albany, N. Y., district.

Douglas O. Johnson and **Leo M. Fagg** have organized the Johnson-Fagg Engineering Co. in Tulsa, specializing in dynanometer well studies and engineering problems in pumping wells. Johnson formerly was a field engineer for Gulf Oil Corp., and Fagg an engineer for S. M. Jones Co.

Troy L. Wilson, Jr., a civil engineering graduate of Tulane University, has joined the mechanical engineering department of the Louisiana division of Standard Oil Co. of New Jersey.

Dr. Walter Miller, who retired March 1 as vice president in charge of manufacturing for Continental Oil Co., has become a consultant on refining operations for Universal Oil Products.

John G. Catlett, Tulsa producer, has been named chairman of a committee of small well operators and others interested in obtaining a permanent price differential for stripper well production. **Ernest Shamblin,** Bristow, Okla., who has been acting as chairman of the group since it was organized last autumn, was chosen executive manager.

M. L. Margenau has been appointed director of public relations for Cities Service Oil Co. succeeding the late R. J. Daugherty. Margenau, who joined Cities Service Co. in 1917, formerly was in charge of surveys, valuation, and rate studies as a member of the staff of Petroleum Advisers, Inc., the technical and coordinating unit of the companys' oil and natural-gas pipe-line subsidiaries.

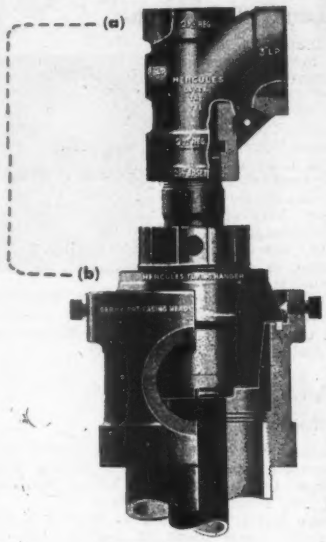
Robert B. Campbell, consulting geologist formerly with Humble Oil & Refining Co. and with Peninsular Oil & Refining Co. in its Florida exploration, has joined **L. A. Casey** in opening a consulting office in Miami, Fla.

D. W. Jopling, F. K. Fisk, and **L. L. Logue,** all former servicemen, have organized Exploration Survey, Inc., geophysical and geological exploration firm, in Dallas. Jopling, president, and Logue, secretary-treasurer, were geologists for Standard Oil Co. (N.J.) before entering the service. Fisk, vice president, formerly was with Mott-Smith Corp., Houston, as a geophysicist.

A. E. Guinn and **Guy W. Fox,** formerly associated with Sheehan Pipe Line Construction Co., Tulsa, have organized Fox & Guinn Pipe Line Construction Co. in Rangely, Colo.

Guy S. Burson, for the last 2 years associated with J. F. Lucey Petroleum Co., Houston, has been appointed Tulsa land representative for Continental Oil Co., succeeding **George F. Burgher,** who has returned to independent leasing operations.

Cecil Morgan, Standard Oil Co. of Louisiana, Baton Rouge, La.; **Melbert Schwarz,** Seaboard Oil Corp., Dallas; **G. C. Jones,** Mississippi Power & Light Co., Jackson, Miss.; and **James P. Evans, Jr.,** and **I. P. LaRue,** both of Jackson, have been added to the Mississippi Oil and Gas Engineering



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(b) Hercules Forged Steel Tubing Hanger—with Forged Steel Slips on which tubing hangs—affords absolute tubing protection. Has the FAMOUS Hercules Packing above slips with threaded nut to distort packing, independent of tubing weight. (Fits any Berry Pattern Casing Head.)

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Committee. The new members raise the committee total to 64.

F. H. Langdon, formerly with Standard Oil Co. of California, has joined the staff of Rothschild Oil Co. as assistant to the president.

Hugh W. Baird has severed his relationships with the pipe line contracting firms of Foreman-Richardson-Baird and C. S. Foreman Co. of Kansas City, Mo. No announcement has yet been made of Baird's future plans.

Jerry Covington, who joined Humble Oil & Refining Co. as geologist at Midland, Tex., following his discharge from the Navy, has been transferred to Roswell, N. M.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington 25, D. C. Notice is hereby given that sealed bids will be received until noon on April 22, 1946, for land described herein situated within the known geologic structure of the Garmesa gas field, 6th P.M., Colorado. This land is offered to qualified bidders of the highest cash amounts per acre as a bonus for the privilege of leasing the land under section 17 of the leasing act as amended by the Act of August 21, 1935 (49 Stat. 674, 30 U.S.C. sec. 226), in the following parcels: Parcel No. 1, T. 7 S., R. 102 W., sec. 31, Lots 7, 8,, 9, 28, 31; T. 7 S., R. 103 W., sec. 36, W½NE¼, SE¼NE¼, SE¼, 317.21 acres. Parcel No. 2, T. 7 S., R. 103 W., sec. 25, S½SW¼; sec. 26 SE¼SE¼; Sec. 35 E½E½; sec 36 W½, 600 acres. Parcel No. 3, T. 8 S., R. 102 W., sec. 4, NW¼SW¼, S½SW¼; sec. 5, lots 31 to 39, inclusive, SE¼SW¼, SW¼SE¼, E½SE¼, 440.11 acres. Parcel No. 4, T. 8 S., R. 102 W., sec. 5, lots 8, 9, 10, 12, 17 to 30 inclusive; sec. 6, lots 8 to 23 inclusive, 647.42 acres. Parcel No. 5, T. 8 S., R. 102 W., sec. 6, lots 24 to 51 inclusive, 583.57 acres. Parcel No. 6, T. 8 S., R. 102 W., sec. 7, lots 5 to 9, inclusive, 17, 18, 123.53 acres. Parcel No. 7, T. 8 S., R. 102 W., sec. 8, lots 1 to 27 inclusive, 32 to 34, inclusive, 560.34 acres. Parcel No. 8, T. 8 S., R. 102 W., sec. 9, lots 1 to 6 inclusive, W½NE¼, E½W½, NW¼NW¼, SE¼; sec. 10, SW¼SW¼, 564.58 acres. Parcel No. 9, T. 8 S., R. 102 W., sec. 15; W½NW¼; sec. 16, lots 1, 2, NE¼, NE¼NW¼, 319.99 acres. Parcel No. 10, T. 8 S., R. 103 W., sec. 1, lots 5, 6, 8, 9, 11 to 17 inclusive, 26 to 30 inclusive, 403.43 acres. Total 4560.18 acres. Bids must be submitted on each parcel separately, but if two or more parcels are awarded to the same bidder they may be included in a single lease, provided the combined acreage does not exceed 640 acres. Each bidder must submit with the bid one-fifth of the amount bid in cash, or by certified check made payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease, required under 43 CFR 192.19. The envelopes should be plainly marked "Bid for Parcel No. .... Garmesa gas field. Not to be opened before noon, April 22, 1946." No bids received after the hour fixed herein for the opening of bids will be considered. The remainder of the bonus and the annual rental at the rate of $1 per acre must be paid and a $5000 corporate surety bond must be furnished by a successful bidder prior to the issuance of a lease. The deposits of the other bidders will be returned upon acceptance of the successful bids by the Secretary of the Interior. The successful bidder will be required to agree not to discriminate against any employe or applicant for employment because of race, creed, color, or national origin, and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

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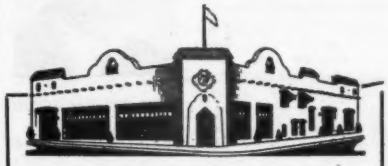

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Equipment Men in the News

Barcklow Made Research Geologist for Lane-Wells Co.

J. C. (Jack) Barcklow, for many years division sales manager of the Mid-Continent division of Lane-Wells Co. at Oklahoma City, has recently been transferred into the general sales department to fill the newly created position of research geologist, with office in Dallas. In this capacity he will coordinate Lane-Wells nation-wide geological experience growing out of its expanding radioactivity well-logging service and engage in extensive research relating to problems of interpretation and special application.

Executives Participate in Industry Conference

HOUSTON.—Executives of several leading oil equipment firms appeared on the program of an "Industry in Action" conference held here under the sponsorship of the National Association of Manufacturers and the Texas Manufacturers Association.

C. K. STILLWAGON

They included C. K. Stillwagon, president of Well Equipment Manufacturing Corp., and head of the state association, who was in charge of the luncheon session; Noah Dietrich, executive vice president of Hughes Tool Co. and regional vice president of N.A.M., who presided at the evening session; and Robert R. Wason, N.A.M. president and president of Manning, Maxwell & Moore, Inc., who spoke at the evening session on "Let's Take Stock Now."

Plymouth Names Dowd Merchandising Manager

Arthur B. Dowd has been appointed merchandising manager for the Plymouth division of Chrysler Corp. Dowd joined the advertising staff of Chrysler in 1933 and was advanced to successively higher positions until February 1942. From that date until his present assignment at Plymouth he served on the staff of the director of labor relations for Chrysler Corp.

New Firm to Give Well Study Service

Specializing in engineering problems related to the operation of pumping wells, Johnson-Fagg Engineering Co. has been organized by Douglas O. Johnson and Leo W. Fagg, known for their work in the field of dynamometer well studies.

"Doug" Johnson, for 8 years manager of the field engineering department of S. M. Jones Co. before joining the mechanical department of Gulf Oil Corp. in 1943, has specialized in well studies, sucker-rod testing and analysis of operating problems. Graduated from University of Minnesota with a B.S. in electrical engineering, he has been a member of the A.P.I. pumping committee, subcommittee on sucker rods, and chairman of the committee on materials. The author of many authoritative papers on field fatigue of sucker rods, he was responsible for sucker rod and tubing specification and application and well studies for the Gulf Oil Corp.

A graduate in industrial engineering from Oklahoma A. & M. College, Leo Fagg was

LEO W. FAGG

D. O. JOHNSON

in the field engineering department of S. M. Jones Co. for the past 9 years. He spent several years in Oklahoma City field, East Texas, Arkansas, North Louisiana and Mississippi analyzing pumping and making dynamometer well studies. He spent 2 years in the Gulf Coast territory before being moved to Tulsa as manager of the Field Engineering Department, and is a member of the materials committee of the A.P.I. The company's offices are in the Thompson Building, Tulsa.

Cooper-Bessemer Expands For South American Trade

Establishment of a branch office in Caracas, Venezuela, to serve expanding markets in that country, Colombia, and Peru, is announced by M. C. Pollock, vice president in charge of export sales for The Cooper-Bessemer Corp., with plants at Mount Vernon, Ohio, and Grove City, Pa.

Thomas E. Kraner has been appointed branch manager in charge of the new South American headquarters. Kraner, a graduate of Purdue University, has been affiliated with Cooper-Bessemer since 1937 and has been with its Washington office for the past 6 years.

Collins Made Assistant Sales Manager of Cameron

William H. Collins has been appointed assistant sales manager for Cameron Iron Works, Inc., Houston. Collins represented Gray Tool Co. in Louisiana for 1½ years and was later associated with Arrow Drilling Co. in Mississippi as a driller, leaving that position to serve as an analyst for Petroleum Administration for War in Washington. Before assuming his present position with Cameron, he was assistant director of the materials division of PAW.

Larkin Sells Davis Boring Tool Division

Larkin Packer Co., Inc., St. Louis, has announced sale of its Davis Boring Tool Division to Giddings and Lewis Machine Tool Co., Fond du Lac, Wis.

Space formerly utilized by Boring in the main St. Louis plant of Larkin will be used in a postwar expansion program for oil-industry equipment manufacture and development, W. H. Larkin, president, said in announcing the sale.

Craig Named by Republic

Appointment of Harvey A. Craig as Pacific Coast manager, Republic Steel Corp., with headquarters in Los Angeles, has been announced by J. M. Schlendorf, vice president in charge of sales. Craig joined the Republic organization in 1943 as manager of the Los Angeles sales office. For many years he was vice president of Reem Manufacturing Co., Richmond, Calif.

Lufkin Sales Engineers Hold Annual Meeting

The sales and service engineers of Lufkin Foundry & Machine Co. met for their annual sales meeting at the head office in Lufkin, Tex., recently.

Sales plans were made for the ensuing year and all of the new equipment offered by this company was discussed at the meeting.

This company is now building a complete line of commercial reduction gears, speed increasers, oil-field pumping engines and truck trailers of the oil-field and van type, in addition to commercial gray iron castings. It also operates a wholesale jobbing business, specializing in industrial and automotive supplies, equipment and parts.

First row: D. A. Reid, E. H. Bounds, L. A. Little, M. B. Harrison, C. D. Richards. Second row: R. L. Miller, A. E. Cudlipp, L. A. Long, A. E. Caraway, W. T. Crowder, J. B. Hopper. Third row: Gus Winn, Robert Lang, J. Taylor Hood, W. H. Miner, Elvin Reed. Fourth row: V. B. Glenn, W. C. Trout, W. W. Trout, H. A. McKerrall, E. P. Trout, G. L. Vickrey, D. K. Womack